

**UNISYS**

**CTOS<sup>®</sup>  
Workstations**

**Planning and  
Owner's Maintenance  
Guide**

**Release**  
Relative to workstations  
with B28/B38, B39, EXP,  
GXL, or LCW processor  
units

**Priced Item**

**January 1992  
Printed in USA**

**4358 3624-000**

**UNISYS**

**CTOS<sup>®</sup>  
Workstations  
Planning and  
Owner's Maintenance  
Guide**

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## Title

**CTOS® Workstations Planning and Owner's Maintenance Guide**

This Product Information Announcement announces the release and availability of the *CTOS Workstations Planning and Owner's Maintenance Guide*.

4358 3624-000 *Planning and Owner's Maintenance Guide only*

This guide covers configuration planning, equipment upkeep, and troubleshooting for CTOS workstations that use B28/B38, B39, EXP, GXL, and LCW processor units. This guide provides information on processor unit families, equipment compatibility, hardware configuration, clustering and networking basics, and other hardware-related topics. This guide does **not** discuss software.

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|               |                                                                                                             |
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Release Workstations with  
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# Page Status

| Page                 | Issue    |
|----------------------|----------|
| iii                  | Original |
| iv                   | Blank    |
| v through xi         | Original |
| xii                  | Blank    |
| xiii through xxi     | Original |
| xxii                 | Blank    |
| 1-1 through 1-33     | Original |
| 1-34                 | Blank    |
| 2-1 through 2-21     | Original |
| 2-22                 | Blank    |
| 3-1 through 3-30     | Original |
| 4-1 through 4-16     | Original |
| 5-1 through 5-17     | Original |
| 5-18                 | Blank    |
| 6-1 through 6-20     | Original |
| 7-1 through 7-18     | Original |
| A-1 through A-3      | Original |
| A-4                  | Blank    |
| Glossary-1 through 9 | Original |
| Glossary-10          | Blank    |
| Index-1 through 14   | Original |



# Contents

|                                                           |      |
|-----------------------------------------------------------|------|
| <b>About This Guide</b> .....                             | xiii |
| <br><b>Section 1. Your Workstation</b>                    |      |
| <b>Workstation Design Concepts</b> .....                  | 1-2  |
| Modularity .....                                          | 1-2  |
| Networking .....                                          | 1-3  |
| <b>Hardware Components</b> .....                          | 1-4  |
| <b>Processor Units</b> .....                              | 1-8  |
| B28/B38 Processor Units .....                             | 1-10 |
| B39 Processor Units .....                                 | 1-13 |
| EXP Processor Units .....                                 | 1-16 |
| GXL Processor Units .....                                 | 1-19 |
| LCW Processor Units .....                                 | 1-22 |
| <b>Processor Unit Enhancements</b> .....                  | 1-24 |
| Memory Expansions .....                                   | 1-24 |
| X-Bus Cards .....                                         | 1-24 |
| <b>Modules</b> .....                                      | 1-26 |
| <b>Monitors</b> .....                                     | 1-28 |
| <b>Keyboards and Special Attachments</b> .....            | 1-30 |
| <b>Where to Go From Here</b> .....                        | 1-33 |
| <br><b>Section 2. Compatibility</b>                       |      |
| <b>Operating Systems and Hardware Compatibility</b> ..... | 2-2  |
| <b>Hardware Compatibility</b> .....                       | 2-3  |
| Processor Unit Compatibility .....                        | 2-3  |
| B28/B38 Processor Units .....                             | 2-3  |
| B39 Processor Units .....                                 | 2-4  |
| EXP Processor Units .....                                 | 2-6  |
| GXL Processor Units .....                                 | 2-7  |
| LCW Processor Units .....                                 | 2-8  |
| Module Compatibility .....                                | 2-9  |
| Modules and Buses .....                                   | 2-9  |
| Disk Upgrades and Expansions .....                        | 2-10 |

## Contents

---

|                                    |             |
|------------------------------------|-------------|
| Peripheral Compatibility .....     | 2-13        |
| Monitors .....                     | 2-13        |
| Other Peripherals .....            | 2-18        |
| Cable Compatibility .....          | 2-18        |
| <b>Where to Go From Here .....</b> | <b>2-21</b> |

### **Section 3. Configuration**

|                                             |             |
|---------------------------------------------|-------------|
| <b>Processor Unit Configuration .....</b>   | <b>3-2</b>  |
| <b>Module Configuration .....</b>           | <b>3-2</b>  |
| Number of Modules per Workstation .....     | 3-3         |
| B28/B38, EXP, and GXL Processor Units ..... | 3-3         |
| B39 Processor Units .....                   | 3-6         |
| Module Combinations .....                   | 3-10        |
| Module Placement .....                      | 3-12        |
| Floppy Disk Drive Addressing .....          | 3-16        |
| Address Format .....                        | 3-16        |
| B25-M0 Addressing .....                     | 3-16        |
| <b>Peripheral Configuration .....</b>       | <b>3-17</b> |
| Peripheral Placement .....                  | 3-18        |
| Number of Peripherals .....                 | 3-18        |
| <b>Power Configuration .....</b>            | <b>3-19</b> |
| Workstation Power Supplies .....            | 3-19        |
| Number of Power Supplies .....              | 3-20        |
| Power Supply Placement .....                | 3-24        |
| B28/B38, EXP, and GXL Families .....        | 3-24        |
| B39 Family .....                            | 3-26        |
| LCW Family .....                            | 3-26        |
| AC Outlets .....                            | 3-26        |
| Surge Protection .....                      | 3-27        |
| <b>Sample Workstations .....</b>            | <b>3-27</b> |
| <b>Where to Go From Here .....</b>          | <b>3-30</b> |

### **Section 4. Clusters and Networks**

|                                          |            |
|------------------------------------------|------------|
| <b>Special Note .....</b>                | <b>4-2</b> |
| <b>Clusters .....</b>                    | <b>4-2</b> |
| Cluster Planning .....                   | 4-3        |
| Number of Workstations per Cluster ..... | 4-6        |
| Cluster Connection Methods .....         | 4-7        |

|                                    |      |
|------------------------------------|------|
| <b>Combined Clusters</b> .....     | 4-10 |
| <b>Networks</b> .....              | 4-10 |
| LANs .....                         | 4-11 |
| LAN Technologies .....             | 4-12 |
| Ethernet LANs .....                | 4-12 |
| Token Ring LANs .....              | 4-14 |
| <b>Combined Networks</b> .....     | 4-14 |
| <b>Where to Go From Here</b> ..... | 4-16 |

## Section 5. Preparing for Installation

|                                                        |      |
|--------------------------------------------------------|------|
| <b>Preparing the Site</b> .....                        | 5-2  |
| <b>Where to Put Your Equipment</b> .....               | 5-3  |
| Physical Placement .....                               | 5-3  |
| Calculating Space Requirements .....                   | 5-4  |
| Distance Factors .....                                 | 5-7  |
| Promoting a Comfortable Workplace .....                | 5-8  |
| <b>Getting Ready</b> .....                             | 5-10 |
| Workstation Inventory, Sorting, and                    |      |
| Record Keeping .....                                   | 5-10 |
| Media Defect Records .....                             | 5-13 |
| <b>Safety Precautions and Equipment Handling</b> ..... | 5-15 |
| Safety Precautions .....                               | 5-15 |
| Equipment Handling .....                               | 5-15 |
| <b>Where to Go From Here</b> .....                     | 5-17 |

## Section 6. Maintaining Your Equipment

|                                  |      |
|----------------------------------|------|
| <b>Owner Maintenance</b> .....   | 6-2  |
| <b>Regular Maintenance</b> ..... | 6-3  |
| Processor Unit and Modules ..... | 6-3  |
| General Maintenance .....        | 6-4  |
| Tape Modules .....               | 6-5  |
| Peripherals .....                | 6-12 |
| Monitors .....                   | 6-12 |
| Keyboards .....                  | 6-13 |
| Mice .....                       | 6-13 |
| Other Peripherals .....          | 6-14 |

## Contents

---

|                                                   |      |
|---------------------------------------------------|------|
| <b>Special Procedures</b> .....                   | 6-15 |
| Rebooting Your Workstation .....                  | 6-15 |
| When to Boot Your Workstation .....               | 6-15 |
| If Your Workstation is Active .....               | 6-15 |
| If You Need to Reboot the Server .....            | 6-16 |
| How to Reboot Your Workstation .....              | 6-16 |
| More About Boot Runs .....                        | 6-17 |
| Turning Off Your Workstation .....                | 6-18 |
| Moving a Workstation or Module .....              | 6-19 |
| Power Failures .....                              | 6-20 |
| <b>Where to Go From Here</b> .....                | 6-20 |
| <br><b>Section 7. Troubleshooting</b>             |      |
| <b>Introduction to Troubleshooting</b> .....      | 7-2  |
| <b>Solving Workstation Failures</b> .....         | 7-3  |
| Common Sense and Deductive Reasoning .....        | 7-3  |
| Preliminary Checks .....                          | 7-4  |
| Installation Problems .....                       | 7-4  |
| <b>Status Codes</b> .....                         | 7-7  |
| Status Code Types .....                           | 7-7  |
| Standard Error Codes .....                        | 7-7  |
| Workstation Startup Codes .....                   | 7-8  |
| How Status Codes Are Reported .....               | 7-10 |
| Monitor Screen .....                              | 7-10 |
| Keyboard LEDs .....                               | 7-10 |
| Audio Reporting .....                             | 7-14 |
| 7-Segment Display .....                           | 7-14 |
| What To Do About Status Codes .....               | 7-15 |
| <b>LCW Startup Test Results</b> .....             | 7-16 |
| <b>Other Diagnostic Tools</b> .....               | 7-18 |
| <br><b>Appendix A. Workstation Specifications</b> |      |
| <b>Environmental Specifications</b> .....         | A-1  |
| Operating Environment .....                       | A-2  |
| Nonoperating Environment .....                    | A-2  |
| Shipping Environment .....                        | A-3  |
| <b>Electrical Specifications</b> .....            | A-3  |
| <br><b>Glossary</b> .....                         | 1    |
| <br><b>Index</b> .....                            | 1    |

# Figures

|       |                                                                           |      |
|-------|---------------------------------------------------------------------------|------|
| 1-1.  | Workstation Components .....                                              | 1-5  |
| 1-2.  | Typical Workstation .....                                                 | 1-7  |
| 1-3.  | Processor Units .....                                                     | 1-9  |
| 1-4.  | B28/B38 Workstation .....                                                 | 1-12 |
| 1-5.  | B39 Workstation .....                                                     | 1-15 |
| 1-6.  | EXP Workstation .....                                                     | 1-18 |
| 1-7.  | GXL Workstation .....                                                     | 1-21 |
| 1-8.  | LCW Workstation .....                                                     | 1-23 |
| 1-9.  | Memory Expansions and X-Bus Cards .....                                   | 1-25 |
| 1-10. | Modules .....                                                             | 1-27 |
| 1-11. | Monitors .....                                                            | 1-29 |
| 1-12. | Keyboards (2 Parts) .....                                                 | 1-31 |
| 2-1.  | Selected Workstation Cables .....                                         | 2-21 |
| 3-1.  | B28/B38, EXP, and GXL Configurations .....                                | 3-5  |
| 3-2.  | B39 X-Bus and SCSI Module Strings .....                                   | 3-7  |
| 3-3.  | B39 X-Bus and SCSI Bus Combinations .....                                 | 3-9  |
| 3-4.  | Module Placement .....                                                    | 3-14 |
| 3-5.  | Module Configuration Form .....                                           | 3-15 |
| 3-6.  | Floppy Disk Drive Addressing .....                                        | 3-17 |
| 3-7.  | Power Supply .....                                                        | 3-19 |
| 3-8.  | Power Supply Configuration Worksheet .....                                | 3-23 |
| 3-9.  | Power Supply Placement for B28/B38, EXP, and GXL<br>Processor Units ..... | 3-25 |
| 3-10. | Sample Workstations .....                                                 | 3-29 |
| 4-1.  | Sample Cluster .....                                                      | 4-5  |
| 4-2.  | Cluster Configurations .....                                              | 4-9  |
| 4-3.  | Basic Network Configurations .....                                        | 4-13 |
| 4-4.  | Combined Network Configurations .....                                     | 4-15 |

## Contents

---

|      |                                                     |      |
|------|-----------------------------------------------------|------|
| 5-1. | String Length Worksheet .....                       | 5-6  |
| 5-2. | Arranging Your Work Space .....                     | 5-9  |
| 5-3. | Inventory Worksheet (2 Parts) .....                 | 5-11 |
| 5-4. | Media Defect Label .....                            | 5-13 |
| 5-5. | Media Defect Worksheet .....                        | 5-14 |
| 6-1. | Inserting a DDS Cleaning Cassette .....             | 6-7  |
| 6-2. | Inserting a Cleaning Pad .....                      | 6-9  |
| 6-3. | Inserting a Cleaning Cartridge .....                | 6-11 |
| 6-4. | Cleaning a Mouse .....                              | 6-14 |
| 6-5. | Reset Switch Location .....                         | 6-17 |
| 7-1. | Workstation Startup and Status Code Reporting ..... | 7-9  |
| 7-2. | 7-Segment Display Location .....                    | 7-15 |
| 7-3. | LCW Status LED Location .....                       | 7-16 |

# Tables

|      |                                                                               |      |
|------|-------------------------------------------------------------------------------|------|
| 1-1. | Typical B28/B38 Workstation Layout . . . . .                                  | 1-11 |
| 1-2. | Typical B39 Workstation Layout . . . . .                                      | 1-14 |
| 1-3. | Typical EXP Workstation Layout . . . . .                                      | 1-17 |
| 1-4. | Typical GXL Workstation Layout . . . . .                                      | 1-20 |
| 1-5. | Typical LCW Workstation Layout . . . . .                                      | 1-23 |
| 2-1. | Upgrades and Expansions . . . . .                                             | 2-11 |
| 2-2. | Disk Upgrade/Expansion Compatibility . . . . .                                | 2-12 |
| 2-3. | Processor Unit Video Capabilities<br>(Without Graphics Controllers) . . . . . | 2-14 |
| 2-4. | Monitor/Processor Compatibility<br>(Without Graphics Controllers) . . . . .   | 2-15 |
| 2-5. | Graphics Controller/Monitor Compatibility . . . . .                           | 2-17 |
| 3-1. | Workstation Power Codes . . . . .                                             | 3-22 |
| 5-1. | Processor Unit and Module Width . . . . .                                     | 5-7  |
| 7-1. | Keyboard LED Bit Conversions . . . . .                                        | 7-12 |
| 7-2. | Binary-to-Hexadecimal Conversions . . . . .                                   | 7-13 |
| 7-3. | Status LED Definitions . . . . .                                              | 7-17 |



# About This Guide

The *CTOS® Workstations Planning and Owner's Maintenance Guide* discusses configuration planning and equipment maintenance for the B2X/B3X product family. This family includes workstations equipped with the following processor units:

- B28-CPU, B28-MCP, B28-EV, or B28-MEV processor units
- B28-EXP or B28-EX1 processor units
- B28-LCW or B28-LC1 processor units
- B38-CPU, B38-MCP, B38-EV, or B38-MEV processor units
- B38-EXP or B38-GXP processor units
- B38-GXL processor units
- All B39 processor units

## Scope

The *Planning and Owner's Maintenance Guide* is a hardware reference; this guide focuses on your system's hardware rather than its software and networking capabilities. For example, the guide tells you how to set up your equipment so that the workstation operates properly. It also explains how to clean your equipment. However, it does not address such issues as software installation, equipment testing, cluster cabling, or local area network (LAN) cabling. For a broader discussion of these topics, refer to the following documents:

- *CTOS System Administration Guide*
- *CTOS Cluster and Network Hardware Installation Guide*
- *CTOS System Software Installation Planning Guide*

Although the guide discusses how to arrange the hardware, it does not provide details on all of the equipment your workstation supports, how to install the workstation, or how to start your equipment. To find out more about compatibility, installation, and startup, read these publications:

- *CTOS Workstations Hardware Compatibility Matrix*
- *CTOS B28/B38 Workstations Hardware Installation Guide*
- *CTOS EXP Workstations Hardware Installation Guide*
- *CTOS GXL Workstations Hardware Installation Guide*
- *CTOS B39 Workstations Hardware Installation Guide*
- *CTOS LCW Workstations Hardware Installation Guide*

The *Planning and Owner's Maintenance Guide* does not discuss media (floppy disks, and so forth). For information on media, see the *CTOS Media User's Guide*.

## Who Should Use This Guide

Anyone installing a B2X/B3X workstation should read this guide. The guide is specially designed for a user who has little or no experience with B2X/B3X equipment. However, the guide also presents theoretical and practical information useful to an expert.

## How to Use This Guide

Use this guide as a background reference when you are preparing to install your workstation. Consult the guide as you plan your installation site and equipment configuration. After you complete the installation, keep the guide handy; you will find its discussion of maintenance and troubleshooting valuable throughout the life of your workstation. Also, if you want to enhance your workstation by adding new devices, use the guide to verify your installation plan.

We strongly urge you to read each section of the *Planning and Owner's Maintenance Guide* at least once, regardless of your experience level. Once you are familiar with its contents, you can use the guide as an occasional reference for difficult configuration problems and equipment upkeep. Here are some pointers on how you should approach the material in the guide.

|                          |                                                                                                                                                                                                                                   |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>All Users</i>         | Regardless of your experience level, be sure to review the sections entitled “Preparing for Installation” and “Maintaining Your Equipment.” These sections contain information crucial to the safe operation of your system.      |
| <i>New Users</i>         | Carefully read the sections entitled “Compatibility,” “Configuration,” and “Clusters and Networks.” These sections tell you how to plan your workstation.                                                                         |
| <i>Experienced Users</i> | If you have installed B2X/B3X workstations in the past, you may already be familiar with much of the planning information in this guide. In this case, scan the text for information that applies specifically to your equipment. |

After you finish this guide, you should be able to complete the following tasks:

- Plan your hardware configuration
- Verify that the installation site meets workstation requirements
- Plan your cluster (if appropriate)
- Plan your network (if appropriate)
- Perform an inventory of the shipping cartons to make sure that all of your equipment arrived
- Clean your workstation and perform regular equipment checks
- Perform basic system troubleshooting and interpret the status codes generated by your equipment

## Organization

The *Planning and Owner’s Maintenance Guide* is organized as follows:

### Section 1. Your Workstation

This section presents an overview of the B2X/B3X workstation, its structure, and its components. Section 1 introduces you to the following equipment: processor units, processor unit enhancements, modules, monitors, and keyboards.

### **Section 2. Compatibility**

This section discusses some of the rules that govern the way you combine your equipment. Section 2 emphasizes the issues surrounding processor unit enhancements and monitor capabilities. For more on workstation compatibility, see the *CTOS Workstations Hardware Compatibility Matrix*.

### **Section 3. Configuration**

This section tells you how to arrange the devices in your workstation. Among the topics covered in Section 3 are processor unit configuration, module configuration, and power configuration.

### **Section 4. Clusters and Networks**

This section covers the basics of clustering and networking. Section 4 is an overview rather than an in-depth discussion of specific planning issues. If you have a cluster or network, you should also read the *CTOS Cluster and Network Hardware Installation Guide*.

### **Section 5. Preparing for Installation**

This section readies you for the practical aspects of installation. Section 5 discusses such topics as equipment placement, workstation ergonomics, and safety practices.

### **Section 6. Maintaining Your Equipment**

This section outlines general workstation maintenance. Section 6 furnishes instructions for powering down a workstation, taking care of the components in your workstation, and resetting the workstation.

### **Section 7. Troubleshooting**

This section discusses some of the problems you may experience with your workstation. Section 7 emphasizes easily implemented solutions. This section also provides details on how to interpret system status codes.

### **Appendix A. Workstation Specifications**

The appendix provides you with various equipment specifications that you should observe during workstation planning.

# Conventions

To simplify discussion, the *Planning and Owner's Maintenance Guide* uses the following conventions:

- The guide refers to the various processor units using the following umbrella terms:

| Umbrella Term | Processor Unit |
|---------------|----------------|
| B28/B38       | B28-CPU        |
|               | B28-MCP        |
|               | B28-EV         |
|               | B28-MEV        |
|               | B38-CPU        |
|               | B38-MCP        |
|               | B38-EV         |
| EXP           | B38-MEV        |
|               | B28-EXP        |
|               | B28-EX1        |
|               | B38-EXP        |
| GXL           | B38-GXP        |
|               | B38-GXL        |
| LCW           | B38-GXL        |
|               | B28-LCW        |
| B39           | B28-LC1        |
|               | B39-1          |
|               | B39-2          |
|               | B39-3          |
|               | B39-4          |
|               | B39-5          |
|               | B39-6          |
|               | B39-7          |
|               | B39-A          |
|               | B39-B          |

- The term “B2X/B3X” refers to workstations that utilize B28/B38, B39, LCW, EXP, and GXL-type processor units.
- The terms “system” and “workstation” are used interchangeably.

## About This Guide

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- The terms “compact disc,” “optical disc,” and “CD-ROM disc” are used interchangeably.
- The terms “diskette” and “floppy disk” are used interchangeably.
- Unless otherwise stated, all directional references assume that you are looking at the front of the equipment. In other words, “left” means “toward the left side as viewed from the front of the module.”

The guide also introduces several new terms. These terms replace older terms formerly used in Unisys documentation. Here is a table listing each new term and the term(s) it replaces.

| New Term         | Old Term                                                               |
|------------------|------------------------------------------------------------------------|
| Server           | Master                                                                 |
| Processor Unit   | Processor                                                              |
| X-Bus™ Card      | Option Board<br>Option Card<br>Internal Option Card                    |
| Memory Expansion | Memory Expansion Cartridge<br>Memory Module<br>Memory Expansion Module |
| Module           | Expansion Module                                                       |
| Tape Module      | Tape Streamer                                                          |

## Related Product Information

Unisys publishes a variety of manuals designed to familiarize you with your workstation and some of the situations you may encounter when operating your workstation. As you plan your documentation library, you may want to review the following volumes. Some of these books ship with your workstation or software. You can order others by calling your sales representative.

## Installing Your Workstation

To help you install your equipment, we provide a number of documents that focus on various issues related to installation. Here is a brief discussion of these documents:

### ***Hardware Installation Guides***

These documents describe the installation and startup procedures for B2X/B3X workstations. Unisys publishes a separate *Hardware Installation Guide* for workstations based on each of the following processor units: B28/B38, B39, EXP, GXL, and LCW. All of the guides include a planning refresher and a brief discussion of workstation troubleshooting.

### ***CTOS Workstations Hardware Compatibility Matrix***

This document indicates which modules and peripherals your processor unit supports.

### ***Installation Sheets***

These documents are pictorial representations of how you install various pieces of equipment. If an installation sheet is available for a particular device, it ships in the carton containing that device.

### ***BTOS™ Hardware Installation Guide***

This document covers the installation procedures for early B2X/B3X workstations; it also provides information on workstation planning. This guide proves helpful if your workstation includes equipment that has a B27 prefix. Information in the *CTOS Workstations Planning and Owner's Maintenance Guide* always takes precedence over information in the *BTOS Hardware Installation Guide* if there is a conflict.

### ***CTOS Cluster and Network Hardware Installation Guide***

This document is a planning aid that discusses such subjects as cable routing for clusters and networks, cable types, and connection methods.

### ***CTOS System Software Installation Planning Guide***

This document tells you how to plan your operating system installation. The guide provides an overview of the installation process and a detailed explanation of the choices you need to make as you install the operating system.

### Operating Your Workstation

Once you begin to operate your workstation, you will probably need documents that cover specific program applications, diagnostic testing, system utilities, and so forth. Here is a list of books that you may find handy:

#### ***CTOS Media User's Guide***

This guide tells you how to insert, remove, and store your media.

#### ***CTOS Executive User's Guide***

This document introduces you to the most commonly used Executive features and utilities. Topics include copying files, completing file backups, creating macro commands, and maintaining a file system.

#### ***CTOS System Administration Guide***

This document defines the administrative aspects of your system software. The *System Administration Guide* furnishes material on setting up various types of operating systems, implementing application software, and installing peripherals.

#### ***CTOS Generic Print System™ Administration Guide***

This document defines the administrative aspects of the Generic Print System (GPS), a software tool that manages printers. In addition to information on GPS, this guide covers printer installation and the basics of troubleshooting.

#### ***CTOS Status Codes Reference Manual***

This two-volume set provides a comprehensive list of status codes generated by your workstation, including bootstrap ROM codes.

#### ***CTOS Visinostics Operations Guide***

This document discusses system diagnostic tests and customizing these tests for your equipment.

## **Other Publications**

As your level of experience increases, you may want to expand your library by adding manuals that pertain to specific applications, special-interest topics, or equipment used in your workstation. Because the selection of available documents is a large one, it cannot be included in this text. For further information, ask your sales representative.



# Section 1

## Your Workstation

This section introduces you to the hardware elements that make up a workstation. If you are working with the equipment for the first time, you should read this section thoroughly before beginning your installation. Section 1 covers the following subjects:

- Workstation design concepts
  - Modularity
  - Networking
- Workstation components and layout
- Processor units
  - B28/B38 processor units
  - B39 processor units
  - EXP processor units
  - GXL processor units
  - LCW processor units
- Processor unit enhancements
  - Memory expansions
  - X-Bus cards
- Modules
- Monitors
- Keyboards and special attachments

# Workstation Design Concepts

The B2X/B3X product line incorporates a wide variety of hardware components. Some of these components help you perform a specific task such as creating a tape archive. Others let you communicate with your processor unit or control the functions of your workstation. Still others allow you to print information, generate artwork, and so forth.

The equipment you receive with your order depends on the needs of your particular site or application. For instance, if you design graphs and charts, your workstation should be equipped with a graphics controller. Users who regularly update large computer files should have one or more disk drives. To more fully understand your particular configuration, you should be familiar with two basic design concepts: modularity and networking.

## Modularity

Your data processing requirements are a product of the type of work you do. If you are an engineer who performs algebraic calculations, your equipment needs are different than those of an office administrator who is in charge of archiving department files. Since your responsibilities often expand over time, your data processing requirements may also increase. To help you meet the challenges of today's information processing environment, your workstation features modular hardware.

With modular hardware, each workstation has three core devices: a processor unit, a monitor, and a keyboard. *Core devices* are hardware components required for your workstation to operate correctly; your workstation *must* have all three core devices or it will not work.

You can enhance the functional range of the core by attaching *modules* to the right side of your processor unit. Modules furnish the workstation with special capabilities like graphics, data storage, and voice processing. Because they are optional, modules can be added to and removed from the workstation as the need arises. For instance, if you decide to keep tape archives of your files, you can add a tape module. If you decide that you no longer want to design artwork, you can remove your workstation's graphics module.

Your modules are electrically connected to your workstation by means of a *bus*. A bus is the circuit that links individual devices together so that they can communicate with one another. The CTOS environment features several types of buses. Prominent among these are the X-Bus and the SCSI (Small Computer System Interface) bus. Your workstation may use one or both of these buses to link your modules to the processor unit; the resulting group of modules is known as a *module string*.

## Networking

Workstations can communicate with one another. This feature allows different workstations to share the same resources, creating a more powerful information processing environment. Configurations that link workstations together are called *clusters*. Clusters are generally made up of several workstations that are attached to a central workstation known as a *server*. The server's function is to provide common services, furnish communications links between users, and store files or applications accessed by all of the workstations.

System planners often choose clusters for applications that service a specialized group of users. For example, a company may have several clusters: one for the accountants, one for the salespeople, and one for the engineers. In this case, each of the clusters is dedicated to a different task and each includes different equipment. Planners also implement clusters to link different types of users, each having different resources. With this type of cluster, several salespeople can electronically transfer sales figures to an artist, who can then develop a sales chart for the next meeting.

Clusters can be attached to other clusters via *local area networks* (LANs) and *wide area networks* (WANs). System planners find this type of configuration valuable when one group of users needs occasional access to files or applications that another group works with daily. For instance, let us say that the corporate design group develops a chart that the marketing group wants to use for a presentation. Networking allows the marketing group to access the corporate design group's files; the marketing group can copy the chart into its cluster and modify the copy so that it better fits a marketing presentation format.

## Hardware Components

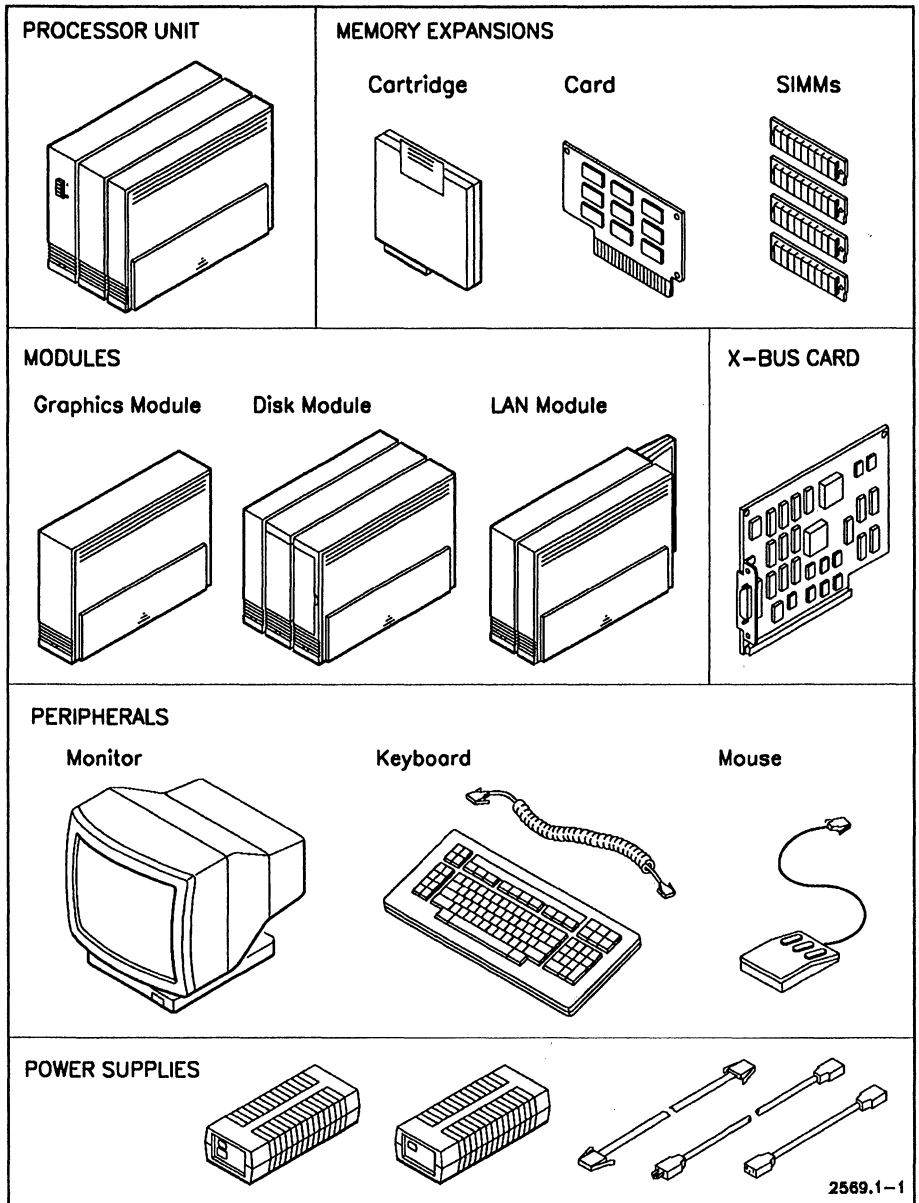
Workstations can include a number of different devices. The following discussion presents a more detailed overview of these devices. Figure 1-1 shows you what some of the devices look like; you may find this figure handy as you unpack your workstation.

**Processor unit** A processor unit is a device that manages the basic functions of your workstation. It includes a *central processing unit* (CPU) that controls the sequences required to complete your commands. It also provides two kinds of memory: permanent memory (used to store internal programs) and temporary memory (used during program execution). You can enhance your processor unit by adding X-Bus cards or more memory.

**Memory expansions** Memory expansions increase the size of your processor unit's memory. With a larger memory, a greater number of programs can be active at the same time. Memory expansions are available in several different forms that will be covered later in this section; the type of memory expansion you receive depends on which processor unit you order. You install memory expansions inside your processor unit.

**Modules** Modules are self-contained devices that provide you with extra capabilities or perform special functions. Some modules include *controllers* (a controller is a set of circuits that governs functions like disk storage or graphics). Modules are attached to the right side of your processor unit.

Unisys offers many different types of modules. Some of these modules perform graphics functions, others furnish disk storage, and still others allow you to connect your workstations to networks.



2569.1-1

**Figure 1-1. Workstation Components**

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>X-Bus cards</i>    | X-Bus cards enhance your workstation's capabilities in much the same way that modules do. In fact, you can think of X-Bus cards as modules without the outer plastic packaging. The main difference between modules and X-Bus cards is that you install X-Bus cards inside your processor unit. This approach conserves X-Bus length in large workstations. X-Bus cards are only available for certain processor units.                                                                                                                      |
| <i>Peripherals</i>    | Peripherals let you interface with your workstation. You use them to issue commands, enter data, and review the progress of your jobs. Included in the peripheral family are monitors, keyboards, mice, printers, and so forth. Although most peripherals are optional, one monitor and one keyboard are required for each system. Without these two devices, you would not be able to communicate with your system. Peripherals are attached to your processor unit or module string via cables. In some cases, you may also need adapters. |
| <i>Power supplies</i> | Power supplies convert ac wall power into voltages used by the workstation. These devices are attached to your equipment via cables.                                                                                                                                                                                                                                                                                                                                                                                                         |

Figure 1-2 shows how these components fit together to form a typical workstation. Do not be concerned if your workstation is missing certain devices or if it includes hardware that does not appear in the drawing. B2X/B3X workstations are custom-tailored to meet your needs and, consequently, their components differ according to the tasks you want them to perform. Even though your workstation may not look like the one in the illustration, make sure that it is equipped with all three core devices (processor unit, monitor, and keyboard).

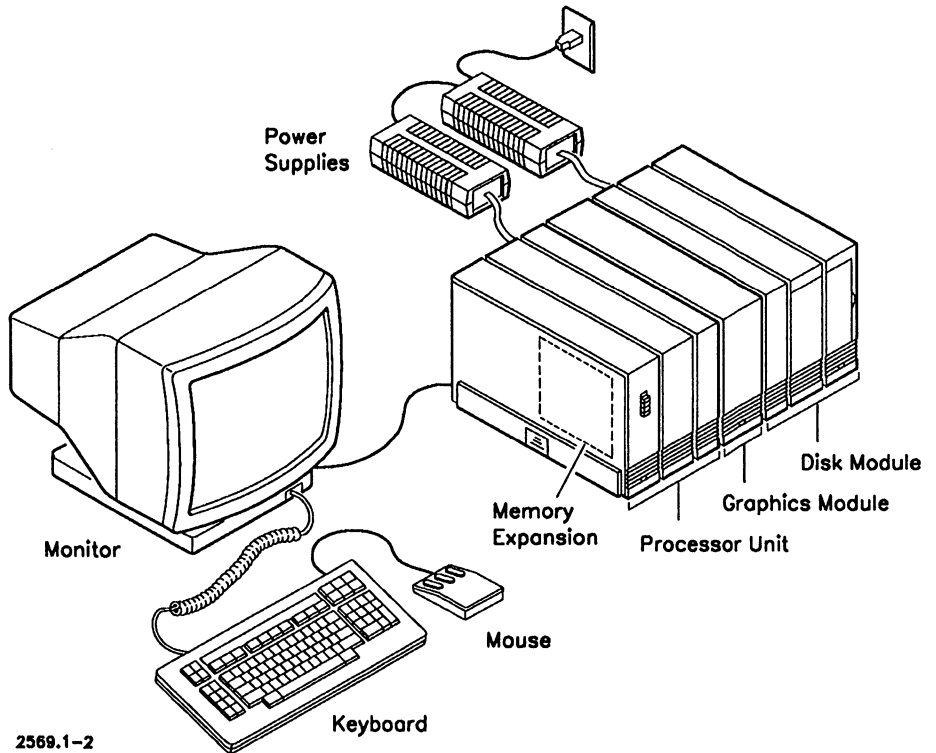


**Figure 1-2. Typical Workstation**

## Processor Units

The B2X/B3X product line offers a wide range of processor units. Your processor unit has been selected according to the tasks you commonly perform and the characteristics of your computer transactions. For instance, if you require advanced graphics capabilities, your processor unit may include enhanced video circuitry. Regardless of their special features, all processor units use the same fundamental hardware technology and the same type of software.

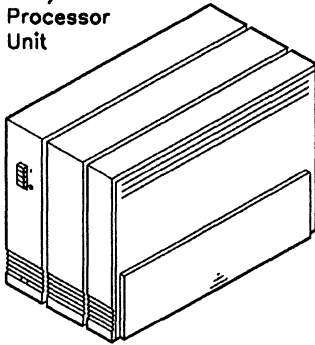
Your processor unit falls into one of the following five categories. Study Figure 1–3 to see what the various processor units look like.

|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>B28/B38<br/>processor<br/>units</i> | These processor units consist of a CPU, main memory, and related circuitry. Although the overall appearance and hardware for the B28 and B38 families are quite similar, the B38 executes at higher speeds. In addition, the B38 incorporates IBM PC® emulation circuitry.                                                                                                                                                                                                                                                                                |
| <i>B39<br/>processor<br/>units</i>     | These processor units contain the same elements as the B38 processor units. They also include a SCSI controller, hard disk drive, and floppy disk drive as part of the processor unit enclosure. Some B39 processor units are equipped with factory-installed X-Bus cards.                                                                                                                                                                                                                                                                                |
| <i>EXP<br/>processor<br/>units</i>     | These processor units also include a CPU, IBM PC emulation logic, main memory, and related circuitry. However, EXP processor units allow you to expand the main memory beyond the bounds of the processor units in the B28/B38 family. For instance, you can configure up to 14 megabytes of memory for the B28-EXP while members of the basic B28 family permit a maximum of 4 megabytes. EXP processor units also support X-Bus cards, further enhancing device capabilities. Some EXP processor units are equipped with factory-installed X-Bus cards. |
| <i>GXL<br/>processor<br/>units</i>     | These processor units are very similar to EXP processor units. Like EXP processor units, GXL processor units support X-Bus cards and up to 14 megabytes of memory. However, GXL processor units include internal graphics control circuitry. You can also directly attach keyboards and VGA monitors to the processor unit.                                                                                                                                                                                                                               |

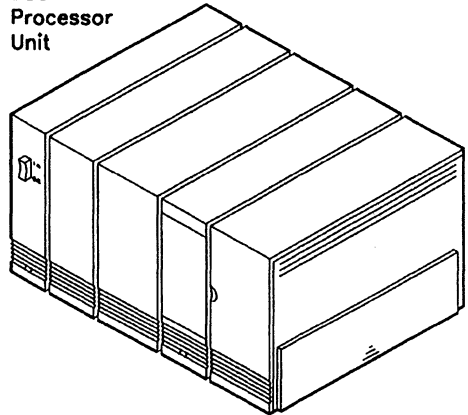
***LCW  
processor  
units***

These processor units are compact versions of other processor units; for example, the B28-LCW is a compact version of the B28-CPU. LCW processor units contain the same hardware components but have a different cabinet shape, providing a space-saving alternative to larger processor units. Because of their construction, you cannot attach modules to LCW processor units.

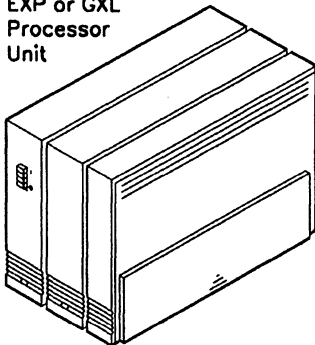
**B28/B38  
Processor  
Unit**



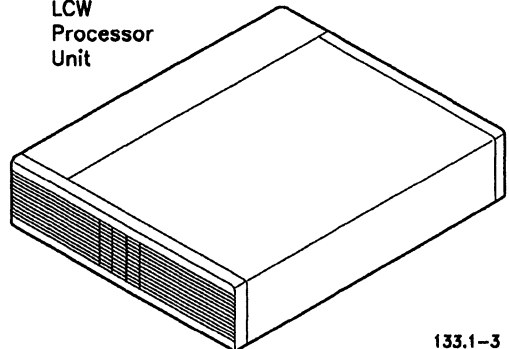
**B39  
Processor  
Unit**



**EXP or GXL  
Processor  
Unit**



**LCW  
Processor  
Unit**



133.1-3

**Figure 1-3. Processor Units**

## B28/B38 Processor Units

The B28/B38 family includes the following eight processor units. If you do not have one of the processor units listed below, skip this discussion.

- B28-CPU
- B28-EV
- B28-MCP
- B28-MEV
- B38-CPU
- B38-EV
- B38-MCP
- B38-MEV

Workstations built around these processor units are physically similar. However, the type of processor unit you select determines your overall system operating characteristics. In some cases, it also governs your configuration range. The following discussion underscores some of the differences between the various processor units as well as some of the characteristics of the B28/B38 family. For information on the devices supported by B28/B38 processor units, see your *Compatibility Matrix*.

- B28 processor units are inscribed with “CPU/286” on the front of the enclosure. B38 processor units, on the other hand, are inscribed with “CPU 386.” The numbers 286 and 386 refer to the type of microprocessor used by the unit. The 386-based processor units are faster and more powerful than 286-based units.
- B38 processor units feature IBM PC emulation capabilities. B28 processor units do not incorporate this capability.

**Note:** *If you want your B28 workstation to emulate an IBM PC, you can configure a PC Emulator™ module and install the PC Emulator software package.*

- Processor units whose names include an M (for example, the B28-MCP) are equipped with a math coprocessor circuit that shortens execution time for math-intensive applications.

- Processor units with an EV in their name (for example, the B28-EV and B28-MEV) feature enhanced video capabilities such as color displays and extra columns. These processor units do not provide graphics functions; to add graphics capabilities, you must configure a graphics module.
- B28/B38 processor units do not support X-Bus cards.
- The memory expansions for B28/B38 processor units are available in the form of cartridges. These cartridges are designed for easy installation; you should not need a service representative's help.

To familiarize you with the general appearance of a B28/B38 configuration, Figure 1–4 shows a typical workstation. The hardware components in the drawing are listed in Table 1–1.

**Table 1–1. Typical B28/B38 Workstation Layout**

| <b>Device</b>     | <b>Location/Connection Type</b>                                                          |
|-------------------|------------------------------------------------------------------------------------------|
| Processor unit    | Located on the left end of the module string                                             |
| Memory expansions | Installed in the processor unit                                                          |
| Modules           | Attached to the right side of the processor unit                                         |
| Monitor           | Connected to the processor unit, graphics module, or monitor adapter (VGA monitors only) |
| Keyboard          | Connected to the monitor or monitor adapter (VGA monitors only)                          |
| Mouse             | Connected to the keyboard                                                                |
| Power supplies    | Connected to the processor unit and, if necessary, to one or more modules                |

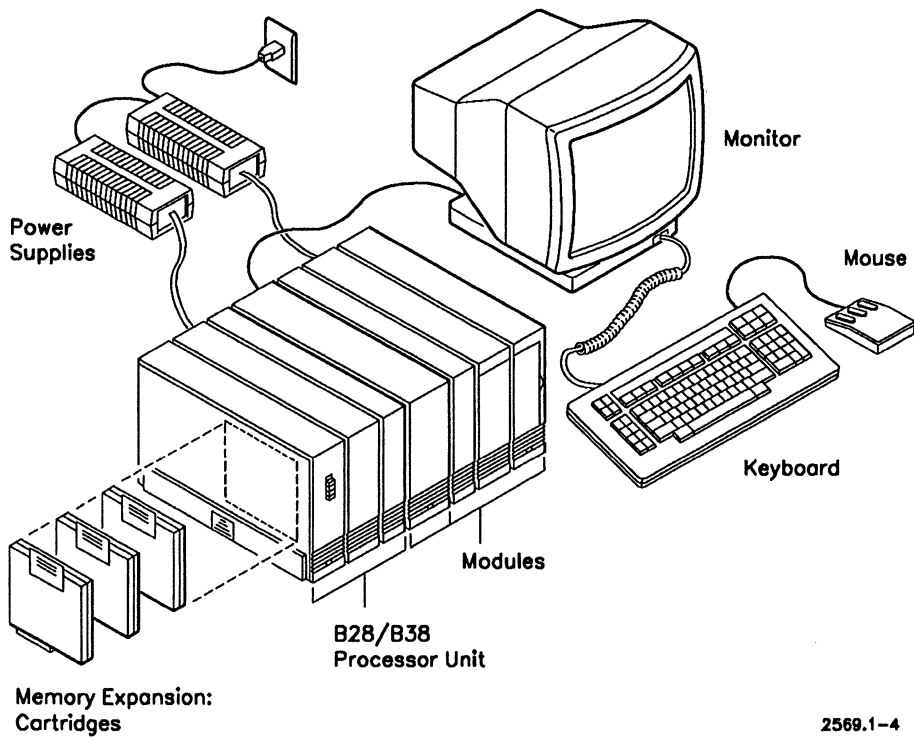


**Figure 1-4. B28/B38 Workstation**

## **B39 Processor Units**

The B39 family includes the following seven processor units. If you do not have one of the processor units listed below, skip this discussion.

- B39-1
- B39-2
- B39-3
- B39-4
- B39-5
- B39-6
- B39-7
- B39-A
- B39-B

The processor units in this family share a common technology and, consequently, their outer appearance is identical. Also, you will find very few differences in the kind of components that you can attach to these processor units. The main factor that distinguishes the members of the B39 series is the capacity of the SCSI hard disk in the processor unit enclosure. For your convenience, here are some of the characteristics of the various B39 processor units. To find out which devices your B39 supports, see the *Compatibility Matrix*.

- All B39 processor units are inscribed with “CPU 386/SCSI” on the front of the enclosure.
- All B39 processor units feature IBM PC emulation capabilities.
- All B39 processor units support a variety of X-Bus cards.
- Memory expansions for the B39 family are known as Single Inline Memory Modules (SIMMs).
- B39 SIMMs and X-Bus cards are not intended for customer installation. Have your service representative install these items for you.
- The B39-3, B39-4, and B39-5 feature a high-speed microprocessor. Consequently, they are faster than other members of the B39 family.

- Processor units that end in an alphabetic letter (for example, the B39-A) are equipped with enhanced video capabilities such as color displays and extra columns. These processor units do not provide graphics functions; to add graphics capabilities, you must configure a graphics controller (X-Bus card or module).
- The B39-1, B39-3, and B39-A provide a 140-megabyte hard disk.
- The B39-2, B39-4, and B39-B furnish a 320-megabyte hard disk.
- The B39-5 is equipped with a 40-megabyte hard disk.
- The B39-6 is equipped with a 240-megabyte hard disk.
- The B39-7 is equipped with a 425-megabyte hard disk.

To familiarize you with the B39 configuration, Figure 1–5 shows a typical workstation. The hardware components in the drawing are listed in Table 1–2.

**Table 1–2. Typical B39 Workstation Layout**

| Device              | Location/Connection Type                                                                 |
|---------------------|------------------------------------------------------------------------------------------|
| Processor unit      | Located on the left end of the module string                                             |
| Memory expansions * | Installed in the processor unit                                                          |
| X-Bus cards *       | Installed in the processor unit                                                          |
| Modules             | Attached to the right side of the processor unit                                         |
| Monitor             | Connected to the processor unit, graphics module, or monitor adapter (VGA monitors only) |
| Keyboard            | Connected to the monitor or monitor adapter (VGA monitors only)                          |
| Mouse               | Connected to the keyboard                                                                |
| Power supplies      | Connected to one or more modules                                                         |

\* X-Bus cards and memory expansions should be installed by your service representative; do not attempt to install them on your own.

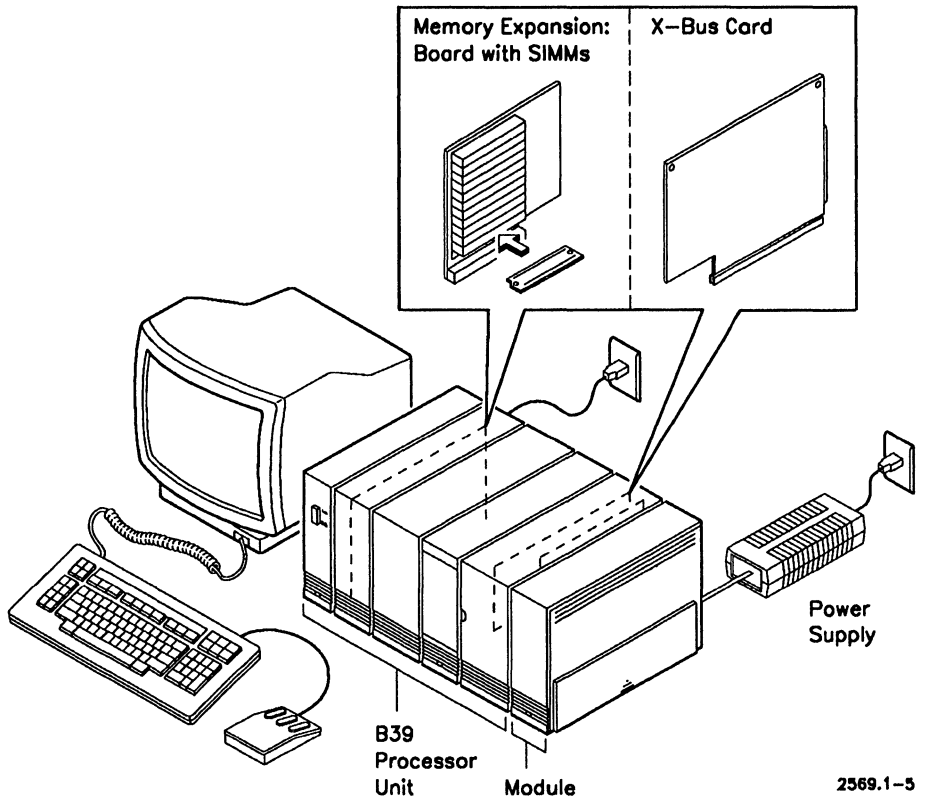


**Figure 1-5. B39 Workstation**

### EXP Processor Units

The EXP family includes the following four processor units. If you do not have one of the processor units listed below, skip this discussion.

- B28-EXP
- B28-EX1
- B38-EXP
- B38-GXP

EXP processor units are enhanced versions of B28/B38 processor units. In fact, EXP processor units look very similar to B28/B38 processor units. Even though they look alike, these two families have a number of internal differences. For example, EXP processor units support X-Bus cards whereas B28/B38 processor units do not. You can review the following discussion to learn more about the EXP family as well as the difference between the B28-EXP/EX1 and B38-EXP/GXP processor units. For information on the devices that EXP processor units support, see your *Compatibility Matrix*.

- B28-EXP and B28-EX1 processor units are inscribed with “CPU/286” on the front of the enclosure. B38-EXP and B38-GXP processor units are inscribed with “CPU 386.” The numbers 286 and 386 refer to the type of microprocessor used by the unit. The 386-based processor units are faster and more powerful than 286-based units.
- All EXP processor units feature enhanced video capabilities such as color displays and extra columns. Except for the B38-GXP, these processor units do not provide graphics functions; to add graphics capabilities, you must configure a graphics controller (X-Bus card or module).
- B38-EXP and B38-GXP processor units incorporate cache circuitry; this circuitry allows faster read operations.
- B38-EXP and B38-GXP processor units feature IBM PC emulation capabilities. B28-EXP and B28-EX1 processor units do not.

**Note:** *If you want your B28-EXP or B28-EX1 workstation to emulate an IBM PC, you can configure a PC Emulator module and install the PC Emulator software package.*

- All EXP processor units support X-Bus cards.
- B38-GXP processor units arrive with a B25-VG1 graphics controller X-Bus card already in place. You cannot install a different X-Bus card without first removing this card.
- B28-EXP, B38-EXP, and B38-GXP processor units are equipped with 2 megabytes of base memory in the form of a memory card.
- B28-EX1 processor units are equipped with 1 megabyte of base memory in the form of a memory card.
- EXP processor units provide memory expansions in the form of individual cards that you install on a carrier.
- Memory expansions and X-Bus cards are designed for easy installation; you should not need a service representative's help.

Figure 1–6 shows a typical workstation; you can use this figure as a guideline for the general appearance of an EXP workstation. The hardware components in the drawing are listed in Table 1–3.

**Table 1–3. Typical EXP Workstation Layout**

| Device            | Location/Connection Type                                                                 |
|-------------------|------------------------------------------------------------------------------------------|
| Processor unit    | Located on the left end of the module string                                             |
| Memory expansions | Installed in the processor unit                                                          |
| X-Bus cards       | Installed in the processor unit                                                          |
| Modules           | Attached to the right side of the processor unit                                         |
| Monitor           | Connected to the processor unit, graphics module, or monitor adapter (VGA monitors only) |
| Keyboard          | Connected to the monitor or monitor adapter (VGA monitors only)                          |
| Mouse             | Connected to the keyboard                                                                |
| Power supplies    | Connected to the processor unit and, if necessary, to one or more modules                |

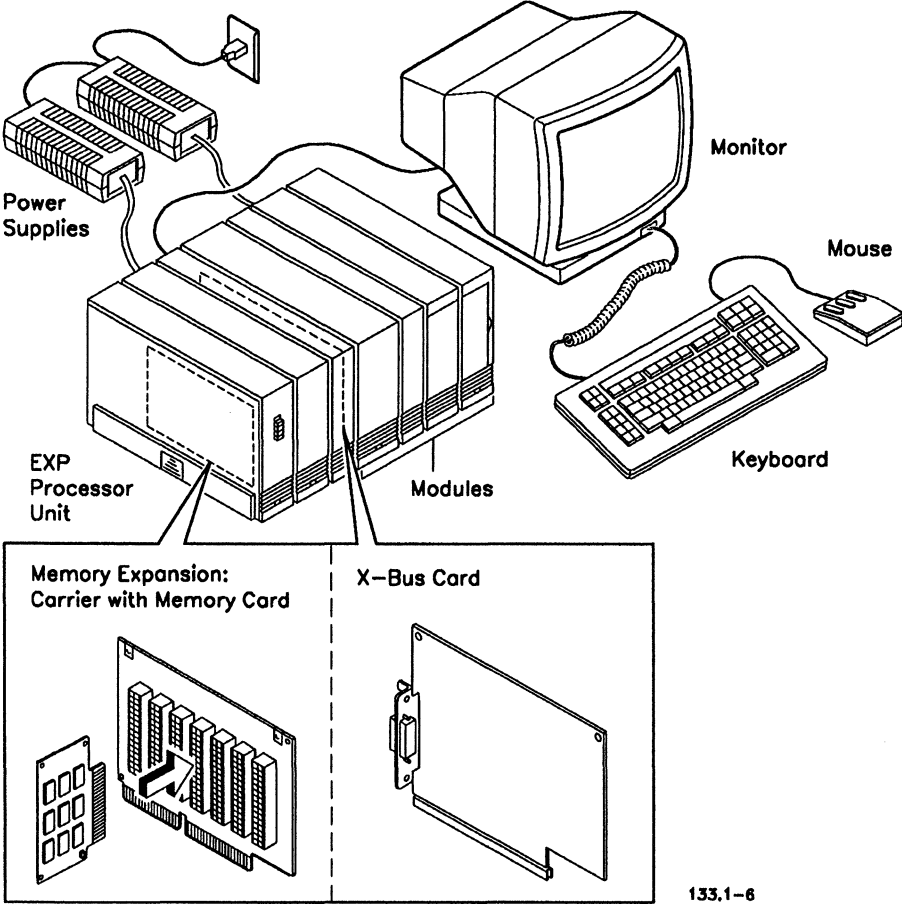


**Figure 1-6. EXP Workstation**

## GXL Processor Units

The GXL family currently includes one processor unit, the B38-GXL. GXL processor units are enhanced versions of EXP processor units. GXL processor units feature internal graphics control circuitry, allowing you to directly attach keyboards and VGA monitors to the processor unit. You can review the following discussion to learn more about the GXL family. For information on the devices that GXL processor units support, see your *Compatibility Matrix*.

- GXL processor units are inscribed with “CPU 386.” The number 386 refers to the type of microprocessor used by the unit.
- GXL processor units feature enhanced video capabilities such as color displays and extra columns.
- GXL processor units provide internal graphics control logic, eliminating the need for graphics modules and graphics controller X-Bus cards.
- GXL processor units incorporate cache circuitry; this circuitry allows faster read operations.
- GXL processor units feature IBM PC emulation capabilities.
- GXL processor units support X-Bus cards.
- GXL processor units are equipped with 2 megabytes of base memory in the form of a memory card.
- GXL processor units provide memory expansions in the form of individual cards that you install on a carrier.
- Memory expansions and X-Bus cards are designed for easy installation; you should not need a service representative’s help.

Figure 1–7 shows a typical workstation; you can use this figure as a guideline for the general appearance of an GXL workstation. The hardware components in the drawing are listed in Table 1–4.

**Table 1–4. Typical GXL Workstation Layout**

| Device            | Location/Connection Type                                                  |
|-------------------|---------------------------------------------------------------------------|
| Processor unit    | Located on the left end of the module string                              |
| Memory expansions | Installed in the processor unit                                           |
| X-Bus cards       | Installed in the processor unit                                           |
| Modules           | Attached to the right side of the processor unit                          |
| Monitor           | Connected to the processor unit                                           |
| Keyboard          | Connected to the monitor or processor unit                                |
| Mouse             | Connected to the keyboard                                                 |
| Power supplies    | Connected to the processor unit and, if necessary, to one or more modules |

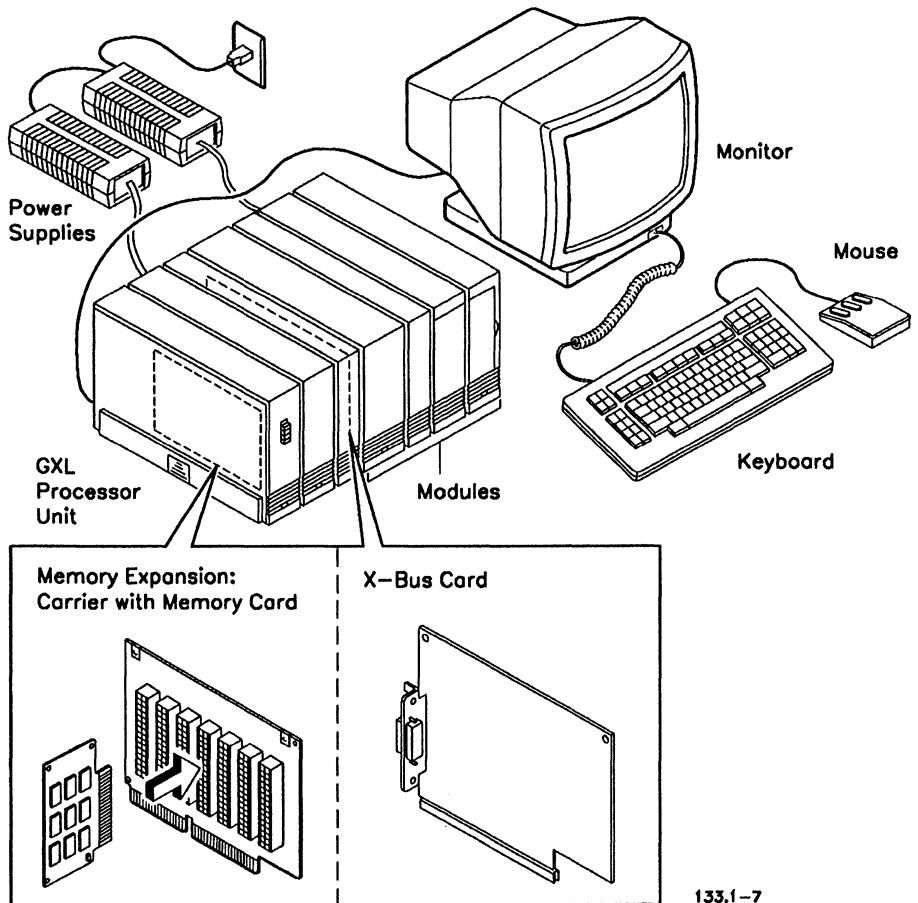


**Figure 1-7. GXL Workstation**

### LCW Processor Units

The LCW family includes the following two processor units. If you do not have one of the processor units listed below, skip this discussion.

- B28-LCW
- B28-LC1

As mentioned, LCW workstations are designed to save office space. Consequently, they do not look like any of the other workstations described in this guide. While other workstations feature processor units that stand vertically, LCW workstations have a horizontal processor unit. As a result, you can stack your monitor on top of your processor unit.

LCW processor units allow you to attach a monitor, a keyboard, and certain peripherals. You can install extra memory in all LCW processor units. However LCW processor units do not support modules. Because you cannot attach modules to LCW processor units, LCW workstations are always part of a cluster. They rely on a server for access to disk files, system resources, and specialized modules.

Here are some of the characteristics of the LCW family. For detailed information on LCW configurations, see your *LCW Hardware Installation Guide*.

- All LCW processor units feature enhanced video capabilities such as color displays and extra columns. These processor units do not provide graphics functions.
- B28-LCW processor units are equipped with 2 megabytes of base memory in the form of a memory card.
- B28-LC1 processor units are equipped with 1 megabyte of base memory in the form of a memory card.
- The B28-LCW and B28-LC1 provide memory expansions in the form of individual cards that you install in your processor unit. For multiple memory expansions, you will also need to install the cards in a carrier.
- Memory expansions are designed for easy installation; you should not need the help of a service representative.

To familiarize you with the LCW configuration, Figure 1-8 shows a typical workstation. The hardware components in the drawing are listed in Table 1-5.

**Table 1-5. Typical LCW Workstation Layout**

| Device              | Location/Connection Type               |
|---------------------|----------------------------------------|
| Processor unit      | Laid horizontally on your work surface |
| Carrier/memory card | Installed in the processor unit        |
| Monitor             | Connected to the processor unit        |
| Keyboard            | Connected to the monitor               |
| Power supply *      | Connected to processor unit            |

\* Required only if a B25-PD8 positive-polarity monitor is used.

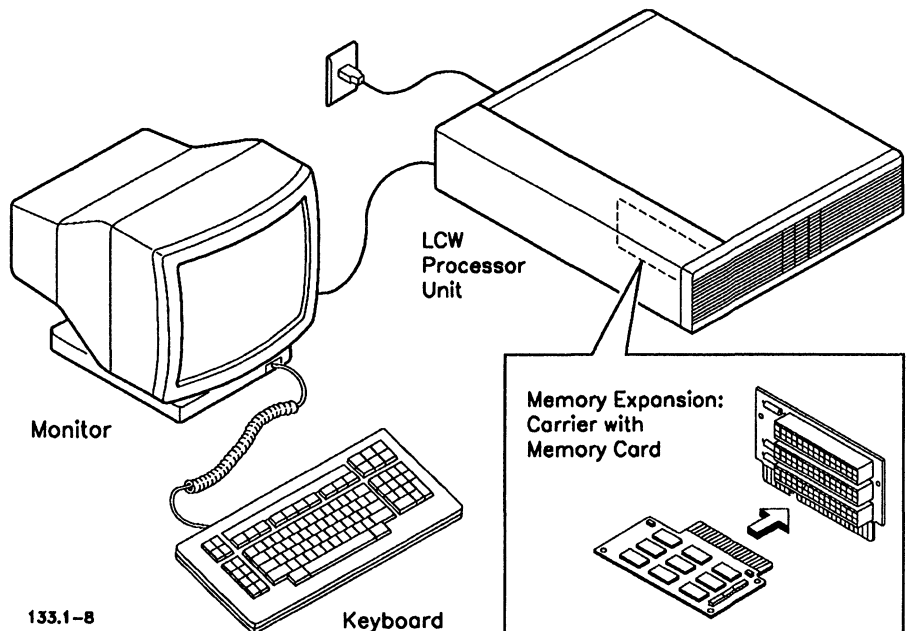


**Figure 1-8. LCW Workstation**

## Processor Unit Enhancements

As mentioned earlier, you can enhance your processor unit by installing memory expansions or X-Bus cards. Here is a description of these two enhancements.

### Memory Expansions

Memory expansions are made up of Random Access Memory (RAM) chips and associated circuitry. Depending on the type of processor unit you order, your memory expansion can take one of four forms: a cartridge, a single card, a carrier/memory card combination, or a group of SIMMs. The following discussion reviews each type of memory expansions; Figure 1–9 familiarizes you with their appearance.

- **Cartridges** – A memory cartridge consists of RAM circuitry encased in a plastic sheath. This design makes it easier for you to install the memory expansion and minimizes the risk of handling damage. Memory cartridges are used in B28/B38 processor units.
- **Single cards (without carrier)** – A memory card consists of RAM circuitry mounted on a card. Memory cards are available for LCW processor units.
- **Carrier/memory card combinations** – A carrier/memory card combination includes two components: the carrier and the memory card. The memory card furnishes the RAM memory. The carrier is a device that provides common connection points for several memory cards. Thus, with this form of memory expansion, you receive one carrier and one or more memory cards. Carrier/memory card combinations are supported by EXP, GXL, and LCW processor units.
- **SIMMs** – A SIMM consists of RAM circuitry mounted on a compact card. Your service representative positions the SIMMs on a SIMM board before installing them. SIMMs are compatible with all B39 processor units and are always ordered in groups of four.

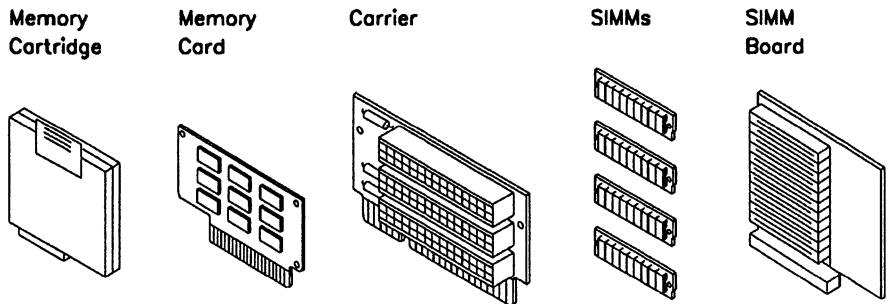
### X-Bus Cards

X-Bus cards incorporate the circuitry needed to complete specific tasks for your workstation. These cards are compact versions of full-sized modules, providing all the functions of the module in card form. If you

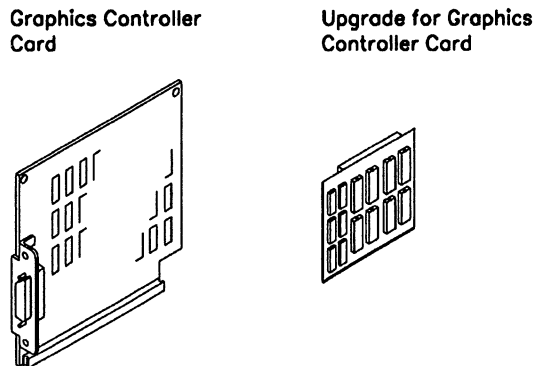
want to reduce the number of modules in your workstation, you can install an X-Bus card in your processor unit and eliminate the module that performs the same function. For example, let us say that you need to add an extra disk module to a workstation but, by doing so, you would exceed the maximum bus length (see “Module Configuration,” in Section 3). In this case, you could substitute a B25-VG3 X-Bus graphics card for the workstation’s graphics module. You would then be free to add the disk module in place of the graphics module.

X-Bus cards are supported by B39, EXP, and GXL processor units. Because of the variety of X-Bus cards available, they will not be covered individually in this discussion. However, Figure 1–9 shows you what various X-Bus cards look like.

#### MEMORY EXPANSIONS



#### X-BUS CARDS



133.1–9

**Figure 1–9. Memory Expansions and X-Bus Cards**

## Modules

Modules are the devices you attach to your processor unit to implement specific functions or capabilities for your workstation. Although the product line features many specialized modules, the following discussion touches on the more popular modules. You can refer to Figure 1–10 for an overview of these modules.

*Disk modules*      These modules let you store data on your workstation and transfer data to floppy disks. This family includes single floppy disk modules, dual floppy disk modules, 3.5/5.25-inch floppy disk modules, floppy/hard disk modules, hard disk upgrades, hard disk expansions, and so forth.

*CD-ROM modules*      These modules allow your processor unit to read data from compact discs. Compact discs store large amounts of information (up to 540 megabytes). The information encoded on these discs is permanent; you can read the discs but you cannot alter their contents in any way.

*Tape modules*      These modules let you store data on quarter-inch cartridge (QIC) or Digital Data Storage (DDS) tape.

*Graphics modules*      These modules provide graphics functions so that you can use applications like the OFIS® Graphics program. In some cases, graphics modules also furnish additional monitor capabilities.

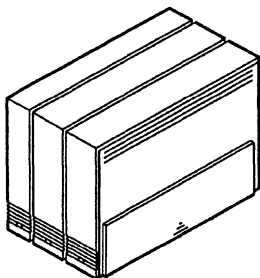
*LAN modules*      These modules allow you to attach your server to other servers so that your cluster can communicate with other clusters.

*Communications modules*      These modules allow you to attach extra peripherals to your workstation. You can also link your server to a wide area network through communications modules.

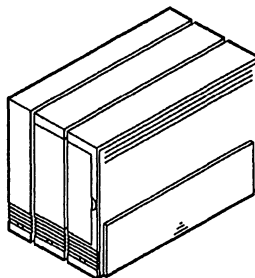
*PC Emulator modules*      These modules allow your workstation to emulate an IBM PC. With a PC Emulator module, your workstation can run most IBM PC DOS-based software.

*Voice Processor™ modules*      These modules provide voice capabilities for applications like the OFIS Document Designer™ program. Additionally, Voice Processor modules function as answering machines.

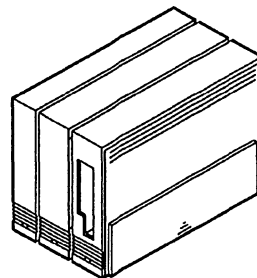
**Disk Module**



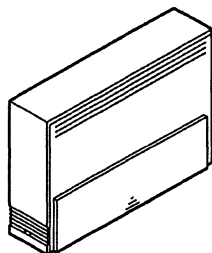
**CD-ROM Module**



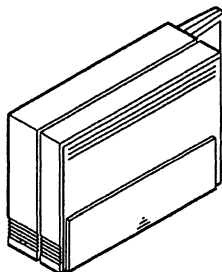
**Tape Module**



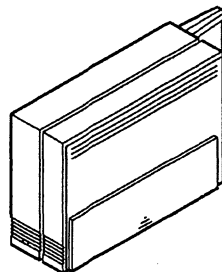
**Graphics Module**



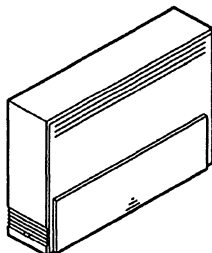
**LAN Module**



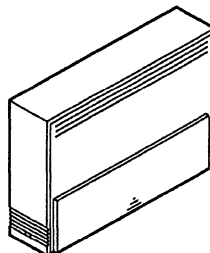
**Communications Module**



**PC Emulator Module**



**Voice Processor Module**



133.1-10

**Figure 1-10. Modules**

## **Monitors**

Monitors are a window to your workstation. Through the monitor, you can view the items that you enter on your keyboard, be they memos, banking transactions, graphs, or pictures. Your monitor can show you which application you are executing, whether your workstation has experienced any unusual conditions, or whether anyone is trying to contact you through a shared network.

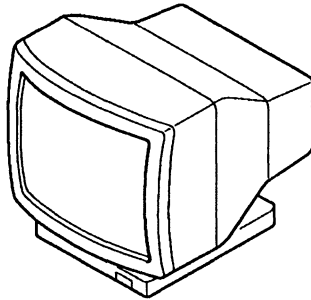
B2X/B3X workstations provide a wide selection of monitors, each designed to meet specific customer requirements. For instance, artists often need to view their work in color to distinguish line weights and shadings. Thus, an artist would be likely to choose a color monitor. An accountant, on the other hand, has no such need and would probably purchase a monochrome monitor.

To familiarize you with the range of monitors available for your workstation, the following list introduces you to the most commonly used monitors. Figure 1–11 shows you what some of these monitors look like. Refer to the *Compatibility Matrix* to determine whether a given monitor is supported by your workstation.

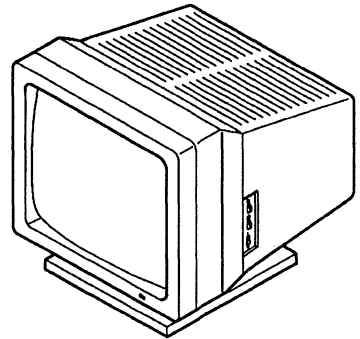
- |                         |                                                                                                                                                                                                                                                              |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>B25-CA1</i></b>   | A high-resolution color monitor that furnishes a 16-inch screen. Color monitors are best suited for applications that involve artwork (for instance, the OFIS Graphics program). The B25-CA1 handles both color graphics and office publishing applications. |
| <b><i>B25-CD3</i></b>   | A color monitor equipped with a 15-inch screen.                                                                                                                                                                                                              |
| <b><i>B25-D1</i></b>    | A monochrome monitor equipped with a 12-inch screen. These monitors are an excellent choice for numeric operations and working with databases.                                                                                                               |
| <b><i>B25-D2</i></b>    | A monochrome monitor equipped with a 14-inch screen. The B25-D2 is also a good choice for mathematical applications and database manipulations.                                                                                                              |
| <b><i>B25-D3</i></b>    | A color monitor equipped with a 15-inch screen.                                                                                                                                                                                                              |
| <b><i>B25-D5/D6</i></b> | Monochrome monitors that feature a 9-inch screen. The B25-D5/D6 is designed for the same applications as the B25-D1.                                                                                                                                         |

- B25-GS1***      A high-resolution gray-scale monitor that furnishes a 15-inch screen.
- B25-PD7***      A positive-polarity monitor that provides a 12-inch screen. Positive-polarity monitors sometimes require special graphics modules.

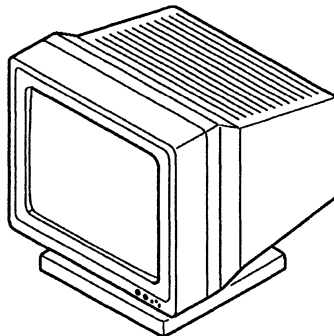
**B25-D2**



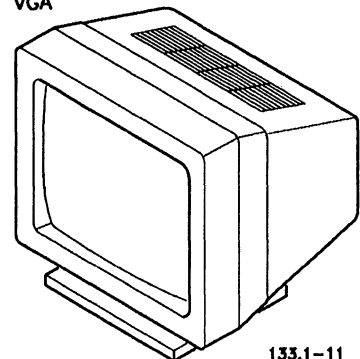
**B25-CA1**



**B25-GS1**



**VGA**



133.1-11

**Figure 1-11. Monitors**

|                                       |                                                                                 |
|---------------------------------------|---------------------------------------------------------------------------------|
| <i>B25-PD8</i>                        | A positive-polarity monitor equipped with a 15-inch screen.                     |
| <i>B25-VDC</i>                        | A 14-inch VGA color monitor.                                                    |
| <i>B25-VDM</i>                        | A 14-inch VGA gray-scale monitor.                                               |
| <i>SG-120-D</i>                       | A high-resolution VGA color monitor.                                            |
| <i>VGA-200-MON</i>                    | A high-resolution VGA gray-scale monitor.                                       |
| <i>VGA-931-VDM</i>                    | A 9-inch VGA monochrome monitor.                                                |
| <i>Off-the-shelf<br/>VGA monitors</i> | High-resolution color monitors manufactured by a variety of commercial vendors. |

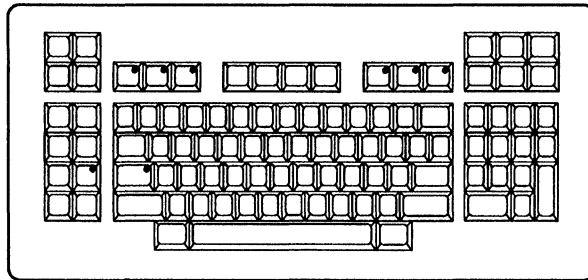
## Keyboards and Special Attachments

Keyboards and special attachments allow you to enter data and commands which are then transmitted to the processor unit. Your workstation may arrive with any of six keyboard styles, depending on the type of data you commonly handle. Each of these styles is designed for specific applications and each has slightly different features. For example, the B25-K4 is equipped with a numeric keypad ideal for financial applications. The B25-K1, on the other hand, furnishes an alphanumeric keypad suitable for data entry. Figure 1–12 shows you the various keyboard styles.

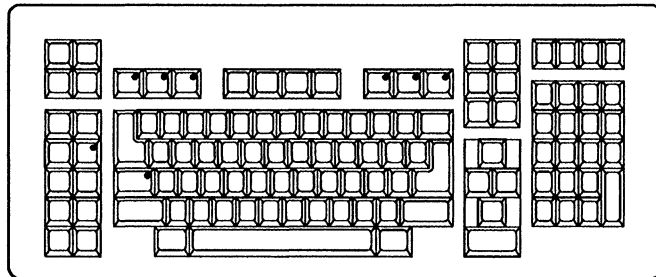
Your workstation may also be equipped with any of several special attachments. The three most common of these are as follows:

|                   |                                                                                                                                                             |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Mouse</i>      | A mouse is a pointing device that lets you position the cursor on the monitor screen. You can then perform operations on the data indicated by your cursor. |
| <i>MCR</i>        | An MCR (magnetic card reader) is a device that reads magnetic cards. MCRs are often used in the banking industry.                                           |
| <i>PIN keypad</i> | A PIN (personal identification number) keypad is a security device that lets you enter a personal code to gain access to information, funds, and so forth.  |

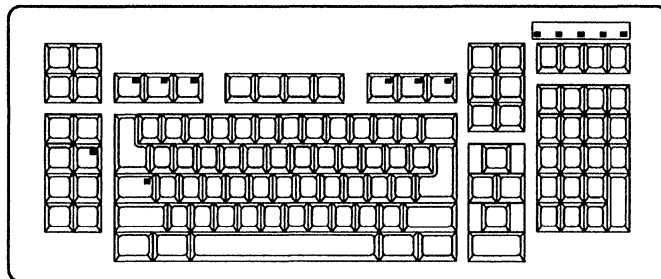
**B25-K1 Keyboard (98 keys)**



**B25-K2 Keyboard (110 or 112 keys)**



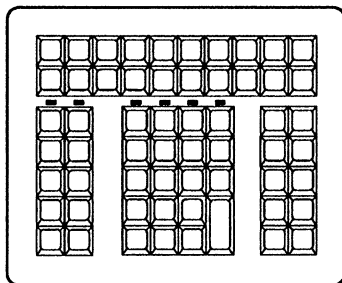
**B25-K3 Keyboard (112 keys)**



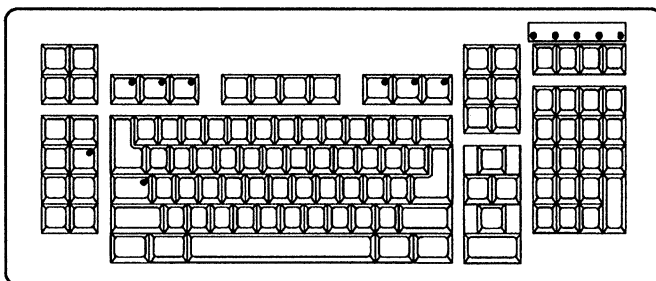
133.1-12

**Figure 1-12. Keyboards (Part 1 of 2)**

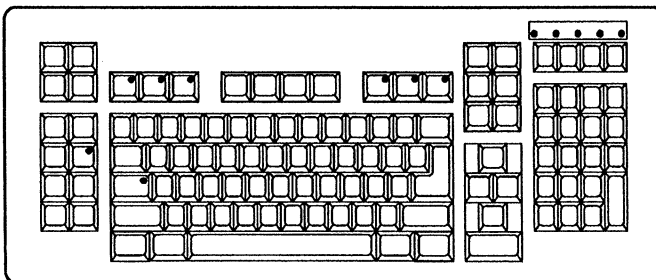
**B25-K4 Keyboard (59 Keys)**



**B25-K5 Keyboard (112 Keys)**



**SG-101-K Keyboard (113 to 115 Keys)**



133.1-12

**Figure 1-12. Keyboards (Part 2 of 2)**

## **Where to Go From Here**

In this section, you learned about the devices that make up your workstation. You should now feel confident with the following tasks:

- You should be able to recognize a processor unit and distinguish it from other devices (for instance, a monitor).
- You should be familiar with the different kinds of modules and some of the functions they perform.
- You should know the difference between an X-Bus card and a memory expansion.
- You should be familiar with the various monitors available for your workstation.

When you are ready, turn to Section 2. This section introduces the rules that determine what kind of equipment your workstation supports.



## Section 2

# Compatibility

This section reviews the guidelines that govern the way you combine your equipment. Rather than simply listing the compatible devices for each processor unit, Section 2 focuses on some of the more complex issues surrounding device compatibility. For questions on specific equipment combinations, see the *Compatibility Matrix* or, if you are an LCW user, the *CTOS LCW Workstations Hardware Installation Guide*.

Those of you working with the equipment for the first time should read this section thoroughly before you begin your installation. Here is an outline of the subjects covered in Section 2:

- Operating systems and hardware compatibility
- Hardware compatibility
  - Processor unit compatibility
  - Module compatibility
  - Peripheral compatibility
  - Cable compatibility

# Operating Systems and Hardware Compatibility

Your hardware is controlled by a set of programs called an *operating system*. The operating system manages the general functions of your workstation. During its life, an operating system can undergo many revisions. Sometimes programmers revise operating systems to provide you with additional software resources. In other cases, an operating system may be expanded to incorporate newly developed hardware. Operating system revisions are usually referred to as versions or levels.

Hardware compatibility is often determined by the operating system level installed for your workstation. For the greatest degree of hardware compatibility, make **sure** to install the most recent operating system level. If you do not keep your operating system current, you may not be able to add newer equipment to your workstation. You should also make sure that your *application software* (programs that perform special tasks like graphics design) is appropriate for your hardware. In other words, do not run applications specifically designed for a B25-GRA graphics module on a workstation that uses a B25-VG1 graphics controller X-Bus card.

## Hardware Compatibility

Your processor unit supports most modules and peripherals in the B2X/B3X product line. However, you should be aware of certain constraints that govern the way you combine equipment.

If you are reading this guide, you are probably preparing to install one or more workstations. You will shortly be faced with a group of cartons, each of which contains a piece of equipment. Although each workstation has been carefully planned to ensure its compatibility, we urge you to read the following discussion of hardware constraints. Those of you installing multiple workstations may find this discussion especially helpful while you sort the equipment.

### Processor Unit Compatibility

The next several paragraphs discuss some of the equipment supported by each of the processor unit families. The discussion focuses on X-Bus cards, memory expansions, and modules.

#### **Notes:**

1. *The following discussion is intended to provide guidelines only. For a definitive statement on compatibility, see the Compatibility Matrix. If you are an LCW user, see the LCW Hardware Installation Guide.*
2. *In the rare event that you are installing the B25-FXC or any module with a B27 prefix, see the BTOS Hardware Installation Guide.*

### B28/B38 Processor Units

The following statements concern B28/B38 processor units only. If you do not have a B28/B38, skip this discussion.

#### **Memory Expansions**

- Your processor unit is equipped with 1 megabyte of base memory.
- You can expand your base memory by adding 1-megabyte memory expansions (B28-1MBs) to your processor unit.
- You can configure as many as three memory expansions, yielding up to 3 megabytes of extra memory (system total: 4 megabytes).

### **X-Bus Cards**

X-Bus cards are not compatible with any of the B28/B38 processor units.

### **Modules**

- You must configure a B25-GPP, B25-VG2, or B25-VG4 graphics module if your workstation includes a B25-PD7 or B25-PD8 monitor.
- If you have a B25-CA1, B25-GS1, B25-VDM, B25-VDC, SG-120-D, VGA-200-MON, VGA-931-VDM, or VGA monitor, you must configure one of the following graphics modules:
  - B25-VG2
  - B25-VG4
- You should not configure the B25-TEM or B25-AG2 modules for your processor unit.
- You can improve the performance of PC emulation mode on B38 processor units by configuring a B25-1PC PC Emulator module.
- Most of the current compact disc applications run under IBM PC emulation mode. Therefore, if you attach the B25-CDC or B25-CDX module to a B28, you should also install the B25-1PC module.

### **B39 Processor Units**

The following statements concern B39 processor units only. If you do not have a B39, skip this discussion.

### **Memory Expansions**

- Your processor unit is equipped with 4 megabytes of base memory.
- You can expand your base memory by adding 4-megabyte memory expansions (B39-4MBs) to your processor unit. Each memory expansion is made up of four 1-megabyte SIMMs.
- You can configure as many as five memory expansions, yielding up to 20 megabytes of extra memory (system total: 24 megabytes).

**X-Bus Cards**

- You can configure the following X-Bus cards for the B39-1, B39-2, B39-3, B39-4, B39-5, B39-6, and B39-7:
  - B25-DN1
  - B25-VG1 (with or without the B25-VGM)
  - B25-VG3
  - B39-EV1
- If you have your service representative remove the B39-EV1 X-Bus card shipped in the processor unit, you can configure the following X-Bus cards for the B39-A and B39-B:
  - B25-DN1
  - B25-VG1 (with or without the B25-VGM)
  - B25-VG3
- If you have a B25-CA1, B25-GS1, B25-VDM, B25-VDC, SG-120-D, VGA-200-MON, VGA-931-VDM, or VGA monitor, you must configure one of the following X-Bus cards:
  - B25-VG1 (with or without the B25-VGM)
  - B25-VG3

**Note:** *As an alternative, you can configure a B25-VG2 or B25-VG4 graphics module.*

**Modules**

- You cannot configure the B25-GPP, B25-GRA, or B25-GRE graphics module for B39 processor units.
- For processor units that do not have a B25-EV1, B25-VG1, or B25-VG3 X-Bus card, you must configure a B25-VG2 or B25-VG4 graphics module if you plan to use a B25-PD7 or B25-PD8 monitor.
- You should not configure the B25-TEM or B25-AG2 modules for B39 processor units.

### EXP Processor Units

The following statements concern EXP processor units only. If you do not have an EXP, skip this discussion.

#### Base Memory and Memory Expansions

- B28-EXP, B38-EXP, and B38-GXP processor units are equipped with 2 megabytes of base memory.
- B28-EX1 processor units arrive with 1 megabyte of base memory.
- You can expand your base memory by adding 2-megabyte memory expansions (B28-2MBs) to your processor unit.
- To add memory expansions, you need to install a carrier (B28-MCE).
- If your workstation includes any X-Bus disk upgrade modules (B25-M3, B25-M4, B25-M5, B25-MC5, B25-MC6, or B25-MU5), you can have up to 8 megabytes of memory, including base memory.
- If your workstation does not include these disk modules, you can configure up to 14 megabytes of memory (13 megabytes for B28-EX1), including base memory.

**Note:** *If your workstation has a graphics controller as well as a B25-IPC module, you can have a maximum of 12 megabytes of usable memory for your processor unit.*

#### X-Bus Cards

- If you have a B38-GXP, your processor unit includes a B25-VG1 graphics controller X-Bus card. You cannot add a different X-Bus card to your processor unit without first removing the B25-VG1.
- If you have a B28-EXP, B28-EX1, or B38-EXP processor unit, you can configure the following X-Bus cards:
  - B25-DN1
  - B25-VG1 (with or without the B25-VGM)
  - B25-VG3

**Note:** *If you have a B25-CA1, B25-GS1, B25-VDM, B25-VDC, SG-120-D, VGA-200-MON, VGA-931-VDM, or VGA monitor, you must configure a B25-VG1 or B25-VG3 X-Bus card. As an alternative, use a B25-VG2 or B25-VG4 graphics module.*

### Modules

- You cannot configure a graphics module for a B38-GXP processor unit. The B38-GXP already incorporates graphics capabilities.
- You cannot configure a B25-GPP graphics module for a B38-EXP processor unit.
- You cannot configure the B25-1PC IBM PC Emulator module for a B38-EXP or B38-GXP processor unit.
- You should not configure the B25-TEM or B25-AG2 modules for your processor unit.
- The B38-EXP and B38-GXP do not support B25-FXC or B27 modules; the other two EXP processor units do.

### GXL Processor Units

The following statements concern GXL processor units only. If you do not have a GXL, skip this discussion.

#### Base Memory and Memory Expansions

- B38-GXL processor units are equipped with 2 megabytes of base memory.
- You can expand your base memory by adding 2-megabyte memory expansions (B28-2MBs) to your processor unit.
- To add the memory expansions, you need to install a carrier (B28-MCE).
- If your workstation includes a B25-M3, B25-M4, B25-M5, B25-MC5, B25-MC6, or B25-MU5 disk module, you can configure up to 8 megabytes of memory (including base memory).
- If your workstation does not include these disk modules, you can configure up to 14 megabytes of memory (including base memory).

#### X-Bus Cards

- You can configure one X-Bus card for the B38-GXL processor unit.
- Since the B38-GXL is already equipped with internal video/graphics circuitry, you cannot configure additional graphics controller X-Bus cards. You can, however, add a B25-DN1 ISDN network X-Bus card.

### Modules

- You cannot configure a graphics module for a B38-GXL processor unit. The B38-GXL already incorporates graphics capabilities.
- You cannot configure the B25-1PC PC Emulator or B25-TEM module for a B38-GXL processor unit.
- You cannot configure the B25-FXC or any module with a B27 prefix for a B38-GXL processor unit.

### LCW Processor Units

The following statements concern LCW processor units only. If you do not have an LCW, skip this discussion.

#### Base Memory and Memory Expansions

- B28-LCW processor units have 2 megabytes of base memory.
- B28-LC1 processor units have 1 megabyte of base memory.
- You can expand your base memory by adding 2-megabyte memory expansions (B28-2MBs) to your processor unit.
- You can configure up to 3 memory expansions, yielding a total of 7 (B28-LC1) or 8 (B28-LCW) megabytes for the processor unit.
- To add more than one memory expansion, you must install a carrier (B28-MCL).

#### X-Bus Cards

X-Bus cards are not compatible with any of the processor units in the LCW family.

#### Modules

Modules are not compatible with any of the processor units in the LCW family.

## Module Compatibility

As long as they are all compatible with your processor unit, you can combine many different kinds of modules in the same module string. However, you should observe certain rules when arranging the modules. Some of these rules govern the way you structure your buses. Others are concerned with how you configure your storage modules. The following paragraphs discuss each of these rules.

**Note:** *If you are installing an LCW-based workstation, you can skip the following discussion.*

### Modules and Buses

As mentioned in Section 1, modules are connected to the workstation by means of one or more buses. A bus is an electrical interface used to transmit signals between the processor unit and the modules. The main interface for your workstation is the X-Bus; most modules utilize this bus for transactions with the processor unit. However, if you perform tasks that require large-capacity storage, your configuration may include SCSI modules; these modules communicate via the SCSI bus. Your workstation can incorporate one or both of these two buses, depending on whether you have X-Bus modules, SCSI modules, or a combination.

The modules associated with each bus are unique to that bus. SCSI modules cannot operate on the X-Bus nor can X-Bus modules operate on the SCSI bus. When you arrange your workstation, remember that you cannot mix modules. You should place all X-Bus modules in one group and all SCSI bus modules in another group.

#### **Notes:**

1. *If you do not know whether one of your modules is an X-Bus module or SCSI module, see the Compatibility Matrix.*
2. *In the rare event that you are installing a B25-FXC or modules with a B27 prefix, see the BTOS Hardware Installation Guide for information regarding SCSI bus compatibility.*

### Disk Upgrades and Expansions

Hard disk modules and compact disk modules are available in two forms: upgrades and expansions. Here are the main differences between upgrades and expansions:

- Upgrades include control circuits capable of governing multiple drives within the bus.
- Expansions do not have their own control functions.

Since expansions are not equipped with their own control circuitry, they rely on upgrades for such tasks as module identification, initialization, and so forth. Consequently, you must make sure that you have enough upgrades to accommodate all of your expansions. Observe the following rules as you configure your upgrades and expansions:

|                      |                                                                                                                                                                                                             |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>X-Bus modules</i> | Include one X-Bus upgrade for every expansion in the X-Bus.                                                                                                                                                 |
| <i>SCSI modules</i>  | Include one SCSI upgrade module at the start of the SCSI string; this upgrade services all of the SCSI expansions in the string. Do <b>not</b> configure more than one SCSI upgrade module per workstation. |

If you have trouble determining whether a particular disk module is an expansion or an upgrade, refer to Table 2-1. This table identifies each module and tells you which bus the module belongs to. Certain disk upgrades do not support all the expansions available for the bus. Table 2-2 indicates which expansions are compatible with each upgrade.

**Table 2–1. Upgrades and Expansions**

| Bus      | Device Type | Device Identifier |
|----------|-------------|-------------------|
| X-Bus    | Upgrade     | B25-M3 *          |
|          |             | B25-M4 *          |
|          |             | B25-M5 *          |
|          |             | B25-MC5           |
|          |             | B25-MC6           |
|          |             | B25-MU5           |
|          | Expansion   | B25-CX5           |
|          |             | B25-CX6           |
|          |             | B25-MX3           |
|          |             | B25-MX4           |
|          |             | B25-MX5           |
|          |             | B25-MX6           |
| SCSI Bus | Upgrade     | B25-CDC           |
|          |             | B25-MS5           |
|          |             | B25-MS6           |
|          |             | B25-MS7           |
|          |             | B25-MS8           |
|          |             | B25-MS9           |
|          |             | B25-MSA           |
|          | Expansion   | B25-CDX           |
|          |             | B25-DDS †         |
|          |             | B25-TS2 †         |
|          |             | B25-XS6           |
|          |             | B25-XS7           |
|          |             | B25-XS8           |
|          |             | B25-XSA           |

\* For the purpose of discussion, the B25-M3, B25-M4, and B25-M5 Combined Floppy/Hard Disk Modules are considered upgrades even though the word "upgrade" does not appear in the product name.

† The B25-DDS and B25-TS2 are tape expansions that require a SCSI hard disk or compact disk upgrade.

**Table 2-2. Disk Upgrade/Expansion Compatibility**

| Expansions | Upgrades * |     |     |            |     | SCSI Upgrades |
|------------|------------|-----|-----|------------|-----|---------------|
|            | M3         | M4  | M5  | MC5<br>MC6 | MU5 |               |
| B25-CDX    |            |     |     |            |     | Yes           |
| B25-CX5    |            |     | Yes | Yes        |     |               |
| B25-CX6    |            |     | Yes | Yes        |     |               |
| B25-DDS †  |            |     |     |            |     | Yes           |
| B25-MX3    | Yes        | Yes | Yes | Yes        | Yes |               |
| B25-MX4    | Yes        | Yes | Yes | Yes        | Yes |               |
| B25-MX5    | Yes        | Yes | Yes | Yes        | Yes |               |
| B25-MX6    |            |     | Yes | Yes        |     |               |
| B25-TS2 †  |            |     |     |            |     | Yes           |
| B25-XS6    |            |     |     |            |     | Yes           |
| B25-XS7    |            |     |     |            |     | Yes           |
| B25-XS8    |            |     |     |            |     | Yes           |
| B25-XSA    |            |     |     |            |     | Yes           |

\* For clarity, the B25 prefix is omitted from the upgrade number.

† The B25-DDS and B25-TS2 are tape expansions.

### Peripheral Compatibility

The rules that govern peripheral combinations are flexible ones. As a result, you rarely encounter an illegal peripheral grouping. You will find, however, that some configurations enhance equipment performance while others prove undesirable for particular applications. Monitors are especially sensitive to configuration.

In setting up the peripheral network for your workstation, you should consider the following guidelines. If you are not sure how monitors are configured, pay close attention to the discussion of video capabilities and graphics controllers.

### Monitors

Your monitor incorporates electronic circuitry that generates visual displays. The nature of these displays, their characteristics, and their graphic capabilities are defined by two components:

- Video management logic in your processor unit
- Graphics controller circuitry

Your video management logic determines the overall appearance of your display; your graphics controller allows you to design artwork. The next several paragraphs discuss these subjects and give you an idea of the kind of displays you can expect from your workstation.

**Note:** *LCW processor units are not compatible with graphics controllers. If you are an LCW user, skip the paragraph entitled "Graphics Controllers."*

### Video Capabilities

The main purpose of your monitor is to display your work, whether it consists of financial spreadsheets or engineering drawings. Depending on your needs, your monitor can be configured with different display characteristics. Many of these characteristics are defined by the control circuitry in your processor unit.

Your processor unit video circuits determine such factors as the number of columns on your screen, its chromatic features, and its brightness. For example, basic processor units like the B28-CPU provide monochrome displays. These processor units cannot generate color displays even if you attach a color monitor. Most other processor units feature enhanced video circuitry that allows color displays. With these processor units, if you have a color monitor, you have a color display. Table 2-3 defines the video characteristics of each processor unit in the B2X/B3X family.

**Table 2-3. Processor Unit Video Capabilities (Without Graphics Controllers)**

| Processor Units                              | Screen Brightness | Chromatic Features * | Column Width | Positive Polarity Monitors † |
|----------------------------------------------|-------------------|----------------------|--------------|------------------------------|
| B28-CPU/MCP                                  | Half-Bright       | Monochrome           | 80 Columns   | No                           |
| B28-EV/MEV                                   | Full-Bright       | Color                | 132 Columns  | Yes                          |
| B28-EXP/EX1                                  | Full-Bright       | Color                | 132 Columns  | Yes                          |
| B28-LCW/LC1                                  | Full-Bright       | Color                | 132 Columns  | Yes                          |
| B38-CPU/MCP                                  | Half-Bright       | Monochrome           | 80 Columns   | No                           |
| B38-EV/MEV                                   | Full-Bright       | Color                | 132 Columns  | Yes                          |
| B38-EXP/GXP ‡                                | Full-Bright       | Color                | 132 Columns  | Yes                          |
| B38-GXL §                                    | Full-Bright       | Color                | 132 Columns  | Yes                          |
| B39-1/2/3/4/5/6/7<br>(no video capabilities) | No Video          | No Video             | No Video     | No                           |
| B39-A/B                                      | Full-Bright       | Color                | 132 Columns  | Yes                          |

\* Assuming a color monitor and no graphics controller (module or X-Bus card).

† B25-PD7 and B25-PD8 monitors.

‡ The B38-GXP includes a B25-VG1 graphics controller X-Bus card. As a result, this processor unit has graphic capabilities not indicated in this chart.

§ The B38-GXL includes graphics control circuitry. As a result, this processor unit has graphic capabilities not indicated in this chart.

To familiarize you with typical processor unit/monitor configurations, Table 2–4 shows you which monitors can be directly attached to which processor units. This table assumes that your workstation does **not** include a graphics controller (with a graphics controller, you can sometimes attach a wider range of monitors).

**Note:** *If a space is blank, the monitor is either incompatible with the processor unit or requires a graphics controller to complete the attachment.*

**Table 2–4. Monitor/Processor Compatibility (Without Graphics Controllers)**

| Processor Units                              | Monitors * |          |     |     |              |              |            |
|----------------------------------------------|------------|----------|-----|-----|--------------|--------------|------------|
|                                              | D1<br>D2   | D5<br>D6 | D3  | CD3 | CA1<br>VDC † | GS1<br>VDM † | PD7<br>PD8 |
| B28-CPU/MCP                                  | Yes        | Yes      |     |     |              |              |            |
| B28-EV/MEV                                   | Yes        | Yes      | Yes | Yes |              |              | Yes        |
| B28-EXP/EX1                                  | Yes        | Yes      | Yes | Yes |              |              | Yes        |
| B28-LCW/LC1                                  | Yes        | Yes      | Yes | Yes |              |              | Yes        |
| B38-CPU/MCP                                  | Yes        | Yes      |     |     |              |              |            |
| B38-EV/MEV                                   | Yes        | Yes      | Yes | Yes |              |              | Yes        |
| B38-EXP                                      | Yes        | Yes      | Yes | Yes |              |              | Yes        |
| B38-GXP ‡                                    | Yes        |          |     | Yes | Yes          | Yes          | Yes        |
| B38-GXL                                      | Yes        |          |     | Yes | Yes          | Yes          | Yes        |
| B39-1/2/3/4/5/6/7<br>(no video capabilities) |            |          |     |     |              |              |            |
| B39-A/B                                      | Yes        | Yes      | Yes | Yes |              |              | Yes        |

\* For clarity, the B25 prefix is omitted from the monitor number.

† The CA1/VDC column also covers SG-120-D and off-the-shelf VGA monitors. The GS1/VDM column also covers VGA-200-MON and VGA-931-VDM monitors.

‡ The GXP processor unit requires a B25-VKA monitor adapter to support B25-VDC, B25-VDM, SG-120-D, VGA-200-MON, VGA-931-VDM, and off-the-shelf VGA monitors.

### Graphics Controllers

You can further enhance your video capabilities by adding a graphics controller to your workstation. Graphics controllers are available in two forms: X-Bus cards and modules. These devices give you the ability to develop graphic material like drawings and charts. Graphics controllers also let you attach different types of monitors to your workstation.

Monitors have two display modes: alphanumeric and graphic. In alphanumeric mode, the characters you see on your screen are letters, numbers, and symbols. This mode is ideal for text-oriented programs like OFIS Document Designer or numerical applications like OFIS Spreadsheet. Graphics mode allows you to create illustrations on your monitor. This mode supports such applications as OFIS Graphics.

Your processor unit provides alphanumeric displays only; it cannot generate graphic output on its own. To activate graphics mode for your monitor, your workstation must include a graphics controller. Table 2-5 shows you which graphics controllers support which monitors. For information on graphics controller/processor unit combinations, see your *Compatibility Matrix*.

**Note:** *B38-GXL processor units are the exception. These processor units include graphics control circuitry and do not need an additional graphics controller (module or X-Bus card).*

**Table 2-5. Graphics Controller/Monitor Compatibility**

| Graphics Controllers             | D1<br>D2 | D5<br>D6 | D3  | Monitors * |              |              |            |
|----------------------------------|----------|----------|-----|------------|--------------|--------------|------------|
|                                  |          |          |     | CD3        | CA1<br>VDC † | GS1<br>VDM ‡ | PD7<br>PD8 |
| B25-GPP                          |          |          |     |            |              |              | Yes        |
| B25-GRA                          | Yes      | Yes      | Yes | Yes        |              |              |            |
| B25-GRE                          | Yes      | Yes      | Yes | Yes        |              |              |            |
| B25-VG1/VG3 and<br>B25-VG2/VG4 § | Yes      |          |     | Yes        | Yes          | Yes          | Yes        |

\* For clarity, the B25 prefix is omitted from the monitor number.

† This column also covers SG-120-D and off-the-shelf VGA monitors.

‡ This column covers VGA-200-MON and VGA-931-VDM monitors as well.

§ The B25-VG1 and B25-VG3 are X-Bus cards.

### VGA Monitors and Monitor Adapters

You can attach VGA monitors to your workstation provided you configure the appropriate graphics controller. However, for B25-VDM, B25-VDC, SG-120-D, VGA-200-MON, VGA-931-VDM, and off-the-shelf VGA monitors, you must use a B25-VKA adapter to connect the monitor to your workstation. This adapter ships with the B25-VDM and B25-VDC monitors. If you have an SG-120-D, VGA-200-MON, VGA-931-VDM, or off-the-shelf VGA monitor, you must order the B25-VKA separately.

**Note:** *B38-GXL processor units include a direct connection for VGA monitors. For this processor unit, you do not need to use a B25-VKA adapter. Instead, you connect the monitor via an adapter cable that ships with the processor unit.*

### Other Peripherals

You can attach many other types of peripherals to your workstation. Keyboards, printers, and data communications products are only a few of the possibilities. Because the selection of peripherals is such a broad one, specific discussions of compatibility are not included in this guide. If you need information on a peripheral device, see the *Compatibility Matrix*. For questions about GPS and printer compatibility, refer to the *CTOS Generic Print System Administration Guide*.

**Note:** *If you are installing a printer, you must also install Generic Print System (GPS) software. For information on GPS, see the Generic Print System Administration Guide.*

### Cable Compatibility

As you unpack your equipment, you will run across a number of different cables. These cables are used to attach peripherals, power supplies, and so forth, to your workstation. To help you understand the purpose of these cables, the following discussion describes some of the more common cables. After reading this text, you should be able to match your cables with the correct devices as you install your equipment. Figure 2-1 illustrates several of these cables.

#### CAUTION

Your shipping cartons should contain all of the cabling you need. If you decide to substitute cables made by another manufacturer, remember that all peripheral cables **must** be shielded to meet FCC and VDE emission standards. Always use Unisys cables or equivalent shielded cables that have 90% braid coverage and a 360° shield termination at the connector. Cables and terminators that do not meet this standard may not provide adequate shielding.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>AC line cable</i>         | <p>AC line cable connects members of your workstation to the ac wall outlet. Here is a discussion of the devices that require ac line cable:</p> <ul style="list-style-type: none"> <li>• B25-PS power supplies – Each power supply is connected to the wall using one ac line cable. You can also connect two power supplies together using the short ac line cable shipped with the B25-PS. In this case, you connect only one of the two power supplies to the wall source.</li> <li>• B25-PS1 power supplies – Each power supply is connected to the wall using one ac line cable.</li> <li>• B39 processor units – B39 processor units are connected to the wall using one ac line cable.</li> <li>• LCW processor units – LCW processor units are connected to the wall using one ac line cable. LCW processor units sometimes have a second wall connection through a B25-PS power supply.</li> <li>• Monitors and peripherals – Certain monitors and peripherals are connected to the wall using one ac line cable. Others receive power through the processor unit.</li> </ul> |
| <i>DC power supply cable</i> | <p>DC power supply cable connects the power supply to the workstation. If you have a B25-PS power supply, the dc power supply cable is the longer of the two cables in the shipping carton.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>Video cable</i>           | <p>Video cable connects the monitor to the workstation. If you have a VGA monitor, you also need a B25-VKA monitor adapter or, for GXL processor units, the video adapter cable that ships with the processor unit.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Keyboard cable</i>        | <p>Keyboard cable connects your keyboard to your monitor. For the GXL family, the cable connects the keyboard to either the monitor or processor unit. The keyboard cable is a coiled cable.</p> <p><b>Note:</b> <i>If you have an SG-101-K keyboard and you plan to attach it to the monitor, you need to order an SG-151-K keyboard cable.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

### *Printer cable*

Printer cable connects your printer to your workstation. Here are some cabling guidelines:

- **Serial printers** – These printers generally use a standard serial printer interface cable. Sometimes serial printers have device-specific cabling, so be sure to check the *CTOS Generic Print System Administration Guide*.
- **Parallel printers** – These printers generally use a Centronics-compatible interface cable. If you have a Qume® Sprint 11/55 Plus, you will need a Qume Connection in addition to this cable.

For further information on printer cabling, see the *CTOS Generic Print System Administration Guide*.

### *Cluster cable*

Cluster cable connects your processor unit to the server. There are two types of cluster cable:

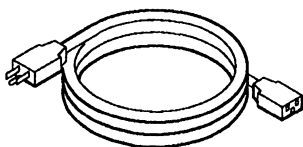
- **RS-422/485 cable** – This cable connects your processor unit to the server through the cluster daisy chain.
- **TeleCluster™ cable** – This twisted-pair cable connects your TeleCluster adapter to the telephone wall jack.

### *LAN cable*

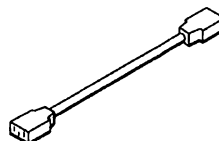
LAN cable connects your server to other servers. There are two types of LAN cable:

- **Ethernet cable** – This coaxial cable connects your server to another server through an X100-MAU (medium attachment unit).
- **Token ring cable** – This 9-to-4 pin adapter cable connects your server to a token ring wire center that acts as a communications hub for the servers in the network.

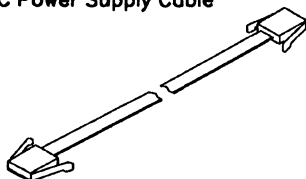
AC Line Cable



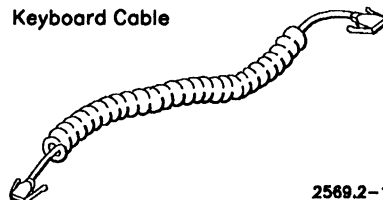
AC Line Cable



DC Power Supply Cable



Keyboard Cable



2569.2-1

**Figure 2-1. Selected Workstation Cables**

## Where to Go From Here

In this section, you learned about the devices that are compatible with your workstation. You should now feel confident with the following tasks:

- You should know which X-Bus cards and memory expansions are compatible with your processor unit.
- You should be able to sort your SCSI and X-Bus modules into separate groups.
- You should understand what display capabilities your monitor will have once it is connected to your workstation.
- You should be able to complete an inventory to ensure that you have all of your workstation cables.

When you are ready, turn to Section 3. This section tells you how to arrange your equipment to ensure that it operates correctly.



# Section 3

## Configuration

This section introduces the principles that govern the way you arrange your equipment. The discussions in Section 3 help you ensure that all of your components are in the proper order. If you are working with the equipment for the first time, read this section thoroughly before beginning your installation. Here is a list of the subjects covered in Section 3:

- Processor unit configuration
- Module configuration
  - Number of modules
  - Module combinations
  - Module placement
  - Floppy disk drive addressing
- Peripheral configuration
  - Peripheral placement
  - Number of peripherals
- Power configuration
- Sample workstations

# Processor Unit Configuration

You can configure one processor unit per workstation. For modular workstations, the processor unit is always the leftmost device in the string; the module string is attached to its right side.

# Module Configuration

In developing your module configuration, you need to consider several issues. For instance, you need to make sure that you do not have too many modules in a particular bus, and you need to determine the order of the modules. To guide you through the planning process, the following paragraphs discuss some of the rules that govern module placement. For the most part, these rules are absolute; if you do not follow them, your workstation will not function correctly. In some instances, the rules can be regarded as recommendations instead of restrictions. The discussion will tell you whenever this is the case.

### ***Notes:***

1. *If your workstation is part of a cluster or network, you should read Section 4 before finalizing your configuration. Section 4 contains information that can affect the way you plan your module string.*
2. *If you are installing an LCW-based workstation, you can skip the following discussion.*

## Number of Modules per Workstation

The number of modules in your workstation is limited by the distance that electronic signals can travel without distortion. This distance, known as *bus length*, varies depending on the bus (X-Bus or SCSI bus). The way you configure your buses is determined by which processor unit you have. The following discussion introduces you to bus length calculation for the B28/B38, EXP, and GXL processor units versus the B39 processor units. As you plan your module string, observe these rules.

### B28/B38, EXP, and GXL Processor Units

The B28/B38, EXP, and GXL processor units accept one group of X-Bus modules and one group of SCSI bus modules. You can configure these modules in three different ways, as shown in Figure 3–1. The following text reviews the three configurations; if you do not have a B28/B38, EXP, or GXL processor unit, skip this discussion.

#### X-Bus Modules Only

- You can configure up to eight X-Bus devices, whether modules or X-Bus cards. Regardless of how many X-Bus devices you have, you must observe the X-Bus length constraints (see next item).
- The combined length of an X-Bus module string cannot exceed 24 inches (61 cm), as shown in Figure 3–1. If you do not observe this limitation, your equipment will experience signal distortion. Here are some pointers on calculating X-Bus length:
  - Looking at the front of your equipment, the length of your X-Bus string is measured from the right side of the processor unit to the right side of the last X-Bus module.
  - Calculate the length of your X-Bus string by noting the width of each module and adding all the widths together. For a quick reference on X-Bus module width, turn to Section 5 and review Table 5–1.

### SCSI Modules Only

- You must install a SCSI upgrade module at the beginning of the SCSI string. The SCSI upgrade is attached directly to the right side of your processor unit.

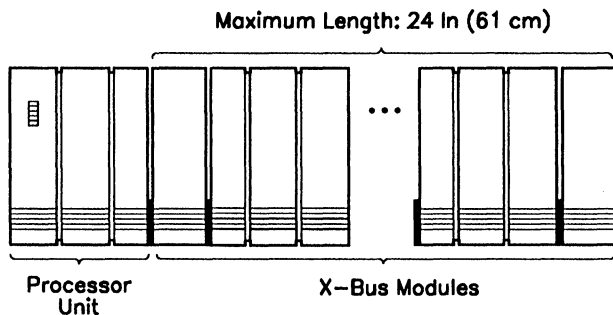
**Note:** *You cannot configure more than one SCSI upgrade for the SCSI string.*

- You can configure up to six SCSI expansion modules for the SCSI string.

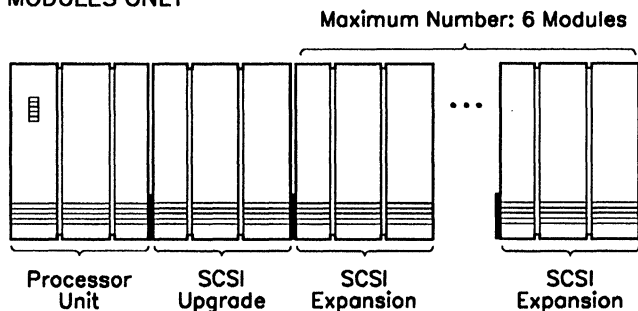
### X-Bus and SCSI Combinations

- You can configure both X-Bus and SCSI modules as long as you group the X-Bus modules together. You cannot intersperse the two types of modules.
- The combined length of the X-Bus module string cannot exceed 24 inches (61 cm).
- You must configure a SCSI upgrade for your SCSI string. You place the SCSI upgrade at the end of the X-Bus string (see Figure 3-1).
- You can configure up to six SCSI expansions for the SCSI string. You attach these devices to the right side of the SCSI upgrade.

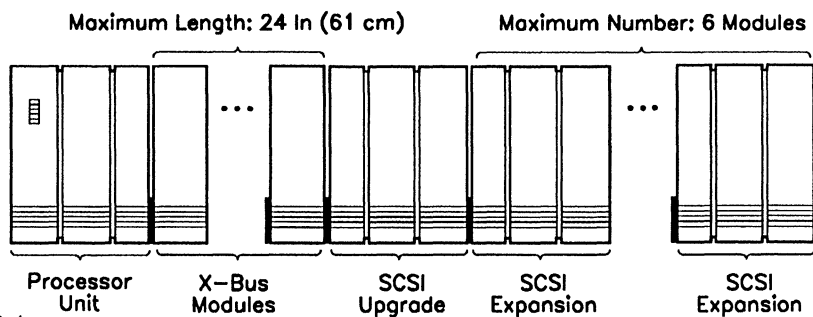
**X-BUS MODULES ONLY**



**SCSI MODULES ONLY**



**X-BUS AND SCSI MODULES**



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**Figure 3-1. B28/B38, EXP, and GXL Configurations**

### B39 Processor Units

The B39 family differs from the B28/B38, EXP, and GXL families in that B39s incorporate a SCSI controller in the processor unit enclosure. As a result, B39 processor units allow X-Bus and SCSI bus combinations not possible for other processor units. For example, with B39 processor units, you can have two SCSI module groups instead of one.

If you have a B39 processor unit, you can configure your modules in a number of different ways; some of the options are illustrated in Figures 3-2 and 3-3. The following text covers the rules for B39 configurations; if you do not have a B39 processor unit, skip this discussion.

#### X-Bus Modules

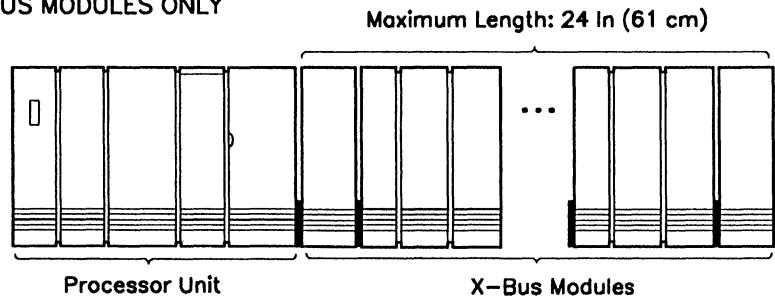
- You can configure up to eight X-Bus devices, whether modules or X-Bus cards. Regardless of how many X-Bus devices you have, you must observe the X-Bus length constraints (see next item).
- The combined length of an X-Bus module string cannot exceed 24 inches (61 cm), as shown in Figure 3-2. If you do not observe this limitation, your equipment will experience signal distortion. Here are some pointers on calculating X-Bus length:
  - Looking at the front of your equipment, the length of your X-Bus string is measured from the right side of the processor unit to the right side of the last X-Bus module.
  - Calculate the length of your X-Bus string by noting the width of each module and adding all the widths together. For a quick reference on X-Bus module width, turn to Section 5 and review Table 5-1.

#### SCSI Modules

- If your SCSI string lies immediately to the right of your processor unit and you have no X-Bus modules, you can configure up to six SCSI expansion modules for the module string (see Figure 3-2).
- If your SCSI string lies immediately to the right of your X-Bus string, you must install a SCSI upgrade module at the beginning of the SCSI string. You can then configure up to six SCSI expansion modules for the module string (see Figure 3-3).

**Note:** *You cannot configure more than one SCSI upgrade module for your SCSI string.*

**X-BUS MODULES ONLY**



**SCSI MODULES ONLY**

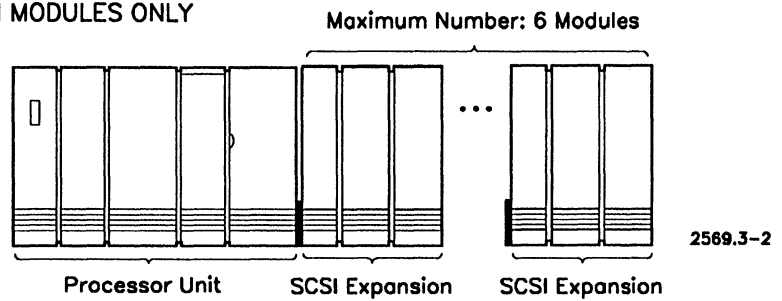


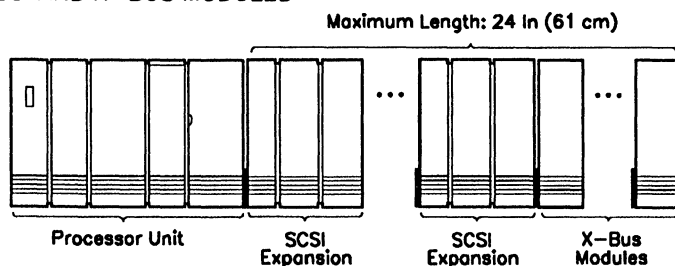
**Figure 3-2. B39 X-Bus and SCSI Module Strings**

### **X-Bus and SCSI Bus Combinations**

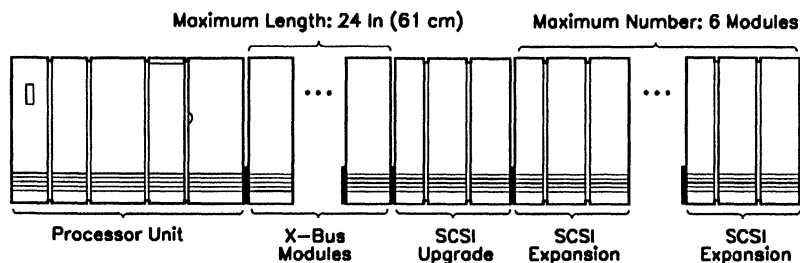
When you have an X-Bus and SCSI bus combination, you need to observe all of the restrictions just discussed as well as the following rules:

- You can configure both X-Bus and SCSI modules as long as you group the X-Bus modules together. You cannot intersperse the two types of modules.
- If you have a group of SCSI modules followed by a group of X-Bus modules, here are your guidelines:
  - You cannot configure a SCSI upgrade module for the string; upgrade functions are already incorporated in the processor unit enclosure.
  - You can configure up to three SCSI expansions. These expansions must be attached to the immediate right of the processor unit (see Figure 3–3).
  - The SCSI expansions are followed by your X-Bus string.
  - The combined length of the SCSI/X-Bus string cannot exceed 24 inches (61 cm). See Figure 3–3 for an example.
- If you have a group of X-Bus modules followed by a group of SCSI modules, here are your guidelines:
  - The combined length of the X-Bus module string cannot exceed 24 inches (61 cm).
  - You must configure a SCSI upgrade for your SCSI string. You place the SCSI upgrade at the end of the X-Bus string (see Figure 3–3).
  - You can configure up to six SCSI expansions for the SCSI string. You attach this group of modules to the right side of the SCSI upgrade.

### SCSI AND X-BUS MODULES



### X-BUS AND SCSI MODULES



### X-BUS AND SCSI MODULES (Two SCSI Groups)

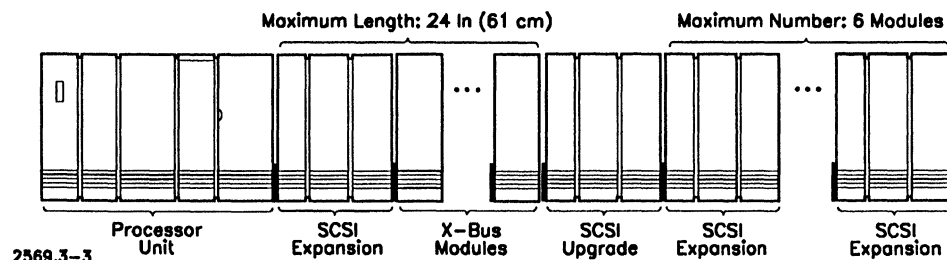


Figure 3-3. B39 X-Bus and SCSI Bus Combinations

## Configuration

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- If you have **two** groups of SCSI modules and one group of X-Bus modules, you attach your first SCSI group to the right side of your processor unit. This group is followed by the X-Bus modules which, in turn, are followed by the second SCSI group. When you configure your module string, observe these guidelines:
  - **First SCSI Group** – You can configure up to three SCSI expansions immediately to the right of your processor unit. Do not configure a SCSI upgrade for this group of modules.
  - **X-Bus Group** – The SCSI expansions are followed by your X-Bus string. The combined length of the first SCSI group and the X-Bus string cannot exceed 24 inches (61 cm). See Figure 3–3 for an example.
  - **Second SCSI Group** – The X-Bus string is followed by your second SCSI group. For this group, you place a SCSI upgrade at the end of the X-Bus string. You can then attach a maximum of six SCSI expansions to the right of the upgrade.

**Note:** *In some configurations, the first SCSI group is directly followed by a SCSI upgrade and the second group of SCSI expansions. In this case, you cannot configure more than four SCSI expansions in the first SCSI group.*

## Module Combinations

You can combine your modules in many different ways. However, there are rules that govern the number of similar modules you can configure for each workstation. As you arrange your equipment, make sure that your configuration adheres to the following guidelines:

- You can have only one graphics controller per workstation. Remember that graphics controllers come in three forms: X-Bus cards, modules, and circuitry inside the processor unit (GXL processor units only). If you are using a GXL processor unit or an X-Bus card graphics controller, you cannot add a graphics module.
- You must install one X-Bus upgrade for each X-Bus expansion.
- You can install up to six SCSI expansions for your SCSI upgrade.
- You can install up to eleven hard disk modules (SCSI and X-Bus) per workstation.

- You can install up to four floppy disk drives per workstation. Since B39 processor units already contain a floppy disk drive, you can install only three floppy drives for B39-based workstations. If you customize the operating system, you can add more floppy drives.

**Note:** *The B25-M0 single floppy disk drive module counts as two floppy drives even though it contains only one drive. For more information, see “Floppy Disk Drive Addressing,” later in this section.*

- You can install up to four SCSI expansions that do not contain magnetic disks. Equipment in this category includes CD-ROM expansions and SCSI tape expansions.
- You can install up to four tape modules (SCSI and X-Bus) per workstation. Only one of these can be an X-Bus tape module.
- You can install up to four Mode 3 modules per workstation. Here is a list of Mode 3 modules:
  - X-Bus tape modules (B25-TS)
  - LAN modules (B25-TR2 or B25-EN3)
  - Intelligent data communications modules (B25-IDS and B25-ID2)
  - Integrated services digital network (ISDN) modules (B25-DN2)
  - Voice Processor modules (B25-TEL)
  - Peripheral extension modules (B25-PEM)
- You can install up to two four-port data communications modules (B25-DCX) per workstation.
- You can install only one IBM PC Emulator module (B25-1PC) per workstation.
- You can install only one Voice Processor module (B25-TEL) per workstation.

- The following items are recommendations rather than rules. Most configurations work best if you observe these recommendations. However, depending on your software and applications, you may find that a different arrangement is more efficient.
  - You should not install more than two intelligent data communications modules (B25-IDS and B25-ID2) per workstation.
  - You can install both token ring (B25-TR2) and Ethernet (B25-EN3) modules on your workstation. However, you generally should not have more than one of either type.
- In the rare event that you are installing the B25-FXC or any module with a B27 prefix, see the *BTOS Hardware Installation Guide*.

## Module Placement

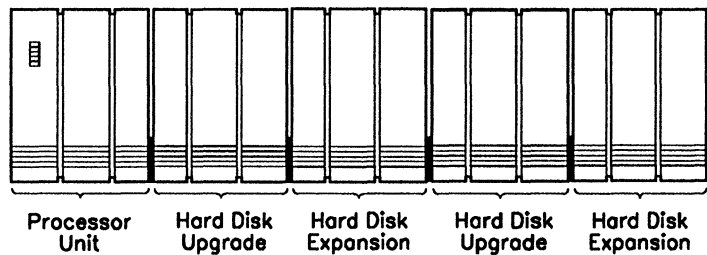
Now that you know how many modules you can configure, you need to think about how to arrange them. The order of your modules is critical to the success of your installation. Some of the factors you should consider as you plan your string are physical convenience and workstation performance. For example, you may want to situate a tape module so that it is within easy reach. Also, if you have different types of LAN modules, workstation performance may be affected by where they lie in relation to each other.

Although you have a great deal of freedom in how you arrange your modules, you should observe the following rules as you plan your configuration. Figure 3–4 illustrates some principles discussed below. To help you configure your workstation, Figure 3–5 provides a module configuration form. Simply take a quick inventory of your equipment and fill in the blank modules according to the following guidelines:

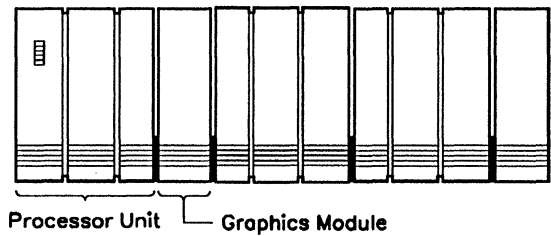
- The processor unit is always the leftmost device in the string.
- The graphics module must be the first module in the X-Bus string. For B39 workstations, place the graphics module immediately after any SCSI expansion modules directly attached to the processor unit.
- If you have an X-Bus expansion module, always place an X-Bus upgrade module to the immediate left of the expansion module. Each X-Bus expansion requires a separate X-Bus upgrade.

- A SCSI upgrade always lies to the left of the SCSI expansion group unless you have a B39 processor unit (in this case, you can attach the SCSI expansions directly to the processor unit).
- If you have a B25-M0 single floppy disk module, be careful when you plan its location. The placement of this module can affect system addressing for all other floppy disk drives in the string. For more, see “Floppy Disk Drive Addressing,” later in this section.
- The B25-1PC, B25-PEM, B25-TEL, and all X-Bus tape or disk modules lie to the left of any B25-IDS or B25-ID2 intelligent data communications modules.
- Do not place any X-Bus modules to the right of the LAN modules (B25-TR2 and B25-EN3) or the SCSI upgrade modules (B25-CDC, B25-MS5, B25-MS6, B25-MS7, B25-MS8, B25-MS9, and B25-MSA).
- If you place a B25-DCX to the left of a module that includes a rear connector extension panel (for example, B25-EN3s and B25-ID2s), use right-angle connectors for the B25-DCX cables.
- You must place at least one module between the B25-DCX and any B39 processor unit.
- The following items are recommendations rather than rules. Most configurations work best if you observe these recommendations. However, depending on your software and applications, you may find that a different arrangement is more efficient.
  - The B25-ID2 and B25-IDS should lie to the left of any B25-TR2 and B25-EN3 modules. If the B25-IDS/ID2 is not the last module in the X-Bus, be sure to use right angle connectors on all B25-IDS/ID2 cables.
  - If you have both a B25-TR2 and a B25-EN3, the B25-TR2 should lie to the left of the B25-EN3.
- In the rare event that you are installing the B25-FXC or any module with a B27 prefix, see the *BTOS Hardware Installation Guide*.

PLACEMENT OF X-BUS UPGRADES AND EXPANSIONS



PLACEMENT OF A GRAPHICS MODULE



PLACEMENT OF IDS/ID2, TR2, AND EN3 MODULES

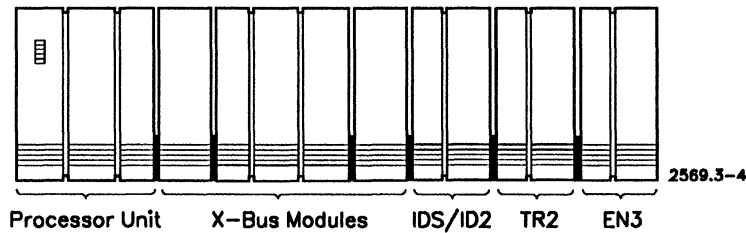


Figure 3-4. Module Placement

Processor Unit

1

Modules

2

3

4

5

6

7

8

9

10

11

12

13

14

15

2569.3-5

Processor Unit

1

Modules

2

3

4

5

6

7

8

9

10

11

12

13

14

15

Figure 3-5. Module Configuration Form

### Floppy Disk Drive Addressing

Your workstation software assigns each module a unique identifier known as an address. This mechanism distinguishes one module from the next. Since addressing is automatic, the subject seldom arises during hardware installation. However, if your workstation includes a B25-M0 single floppy disk module, read the following discussion.

#### Address Format

Module addresses are two or more characters long. Some characters are letters and others are digits. All floppy disk drive addresses start with the same letter or group of letters. For most systems, this letter is “F”. The “F” is followed by a digit that indicates the drive’s position relative to the other floppy disk drives. The leftmost floppy disk drive in a string is addressed as F0, the next is addressed as F1, and so forth.

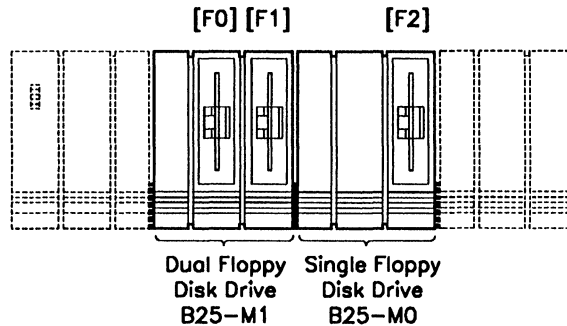
#### B25-M0 Addressing

The B25-M0 incorporates advanced control circuitry designed to manage two floppy disk drives. As a result, your workstation software assumes that the B25-M0 includes two drives even though it only has one. Accordingly, the software reserves two addresses for the B25-M0. For example, if your B25-M0 is the leftmost floppy disk module in the string, the software reserves addresses F0 and F1. Of these two addresses, only F0 is active.

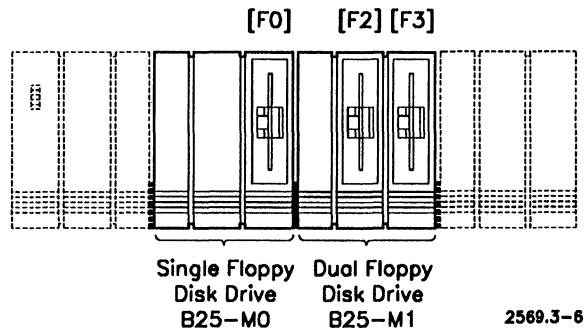
Some workstations include both a B25-M0 and some other type of X-Bus floppy disk module. For these workstations, we suggest that you place the other floppy disk module to the left of the B25-M0. This measure ensures that your floppy disk drive addresses will be consecutive. Figure 3–6 shows you an example.

As an alternative, you can place the B25-M0 to the left of the other floppy disk module. However, in this case, the software skips an address. The resulting address scheme assigns F0 to the B25-M0, F2 to the next floppy disk drive, and F3 to the third floppy disk drive (if present). F1 is reserved for the phantom B25-M0 drive; if you attempt to execute commands against address F1, they will fail. Figure 3–6 also illustrates this approach.

### SUGGESTED CONFIGURATION



### ALTERNATE CONFIGURATION



2569.3-6

**Figure 3-6. Floppy Disk Drive Addressing**

## Peripheral Configuration

Peripherals have relatively straightforward configurations. When you configure your peripherals, you need to consider two issues. One of these issues is where to attach your peripherals. The other is how many to attach. The next several paragraphs discuss both issues.

### Peripheral Placement

You can attach your peripherals to your processor unit, monitor, module string, or keyboard. Here are some pointers:

- You can attach monitors, printers, financial equipment, and data communications devices to your processor unit. For GXL processor units, you can also attach a keyboard.

**Note:** *There are special rules that govern keyboard placement for GXL processor units. For information on these guidelines, see the GXL Hardware Installation Guide.*

- You can attach a monitor to your graphics module.
- You can attach a keyboard to your monitor.
- You can attach printers, data communications devices, and financial peripherals (MCRs and PIN keypads) to B25-PEM modules.
- You can attach printers and data communications devices to B25-DCX modules.
- You can attach mice, graphics tablets, and magnetic card readers to your keyboard.

### Number of Peripherals

The number of peripherals you can attach depends on how many peripheral ports your workstation has. Observe these guidelines:

- You cannot attach more than one monitor or keyboard per workstation.
- You can attach one monitor, two serial peripherals (printers, modems, and so forth), and one parallel peripheral (generally a printer) to your processor unit. For EXP and GXL processor units, you can also attach one financial peripheral to the financial system architecture (FSA) port. Additionally, GXL processor units allow you to attach a keyboard.
- You can attach up to three peripherals to the B25-PEM module. If you plan to attach a PIN keypad and/or MCR, you should make sure you have the correct adapter; see the PIN keypad and MCR installation material for details.

- You can attach up to four peripherals to the B25-DCX module; you can also attach this module to a wide area network (WAN).
- You can attach one peripheral to your keyboard.

## Power Configuration

Once you have finalized the layout of your modules, you need to spend a few moments on workstation power. If you are unfamiliar with the subject of power, don't be concerned. You can successfully configure your workstation's power with very little specialized knowledge. The main issues you will consider are:

- Number of power supplies
- Power supply placement

### Workstation Power Supplies

All electrical equipment runs on voltage, another name for electrical force. There are two types of voltage: dc voltage and ac voltage. DC voltage is supplied at steady, nonfluctuating levels. AC voltage, on the other hand, swings back and forth between equally positive and negative voltage levels. AC and dc voltage are not equivalent. If you plug a piece of dc equipment directly into an ac socket, you can often damage it.

Like most computer equipment, your workstation requires dc voltages. Your wall outlet, however, provides only ac voltage. In order to operate your workstation, you must convert the ac wall voltage into dc voltage. B2X/B3X workstations are equipped with a device custom-designed for this task. This device is known as a power supply (shown in Figure 3-7).

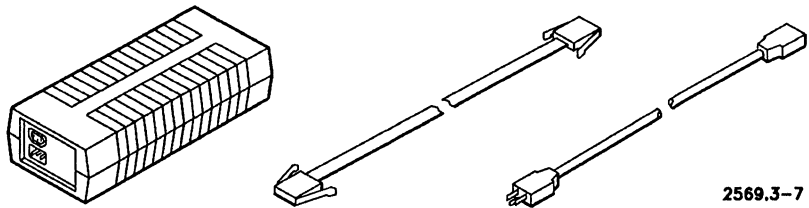


**Figure 3-7. Power Supply**

The number of power supplies your workstation needs depends on the equipment it includes. Workstations with many modules require more power supplies than workstations with only a few. The placement of your power supplies is also sensitive to the type of equipment you have. If you read the next paragraphs thoroughly, you should have no trouble configuring your workstation's power supplies.

### Number of Power Supplies

Your workstation is compatible with the following two power supplies: the B25-PS and the B25-PS1. It may arrive with either or both. The B25-PS is rated at approximately 150 Watts while the more powerful B25-PS1 is rated at 225 Watts. The greater the number of Watts, the more devices the power supply can support.

To eliminate the need for complex power calculations, your power supply is assigned a *power code* that reflects the number of power units it can support. A *power unit* is a simplified expression of how much power a device either supplies or consumes. The B25-PS has power code of 10, meaning that it can supply 10 dc power units to the workstation. The B25-PS1 has a power code of 15 and supplies 15 dc power units.

Each device that requires a dc voltage source also has a power code. In this case, the power code reflects how many power units the device needs in order to operate. For your reference, Table 3-1 lists the power codes for each device that has one; you can also find a power code label on the back of the device. If a device is not labeled, it receives its power from another source and, thus, has no power code.

Before installing your workstation, you should have a general idea of how many power supplies your workstation needs. For a rough approximation, complete the following simple procedure:

**Note:** *Some workstations require one extra power supply for the last module in the string. Whether or not you need an extra power supply depends on how you arrange your modules. For more on this subject, read the paragraph entitled "Power Supply Placement," later in this section.*

1. Review your module configuration and fill out the “Equipment” column in Figure 3–8. If you have a B39 workstation that does not include a graphics module, use the first set of columns. For all other configurations, use the second set of columns. LCW owners do not need to complete this exercise.
2. Review Table 3–1 to determine the power code for each of the devices in your workstation. Copy this information onto the form in Figure 3–8.

**Note:** *If you have a B28/B38, EXP, or GXL processor unit, do not forget the power code for your monitor. For B39 processor units, only include the monitor power code if your system is equipped with a graphics module.*

3. Add the power codes together and divide the sum by one of the numbers listed below.
  - For B25-PS power supplies, divide by 10.
  - For B25-PS1 power supplies, divide by 15.
  - For workstations that include both power supplies, adjust your math accordingly.
4. If the result is a fractional number, round the number upward (in other words, round 2.3 upward to 3).
5. Use the rounded number as an approximation of how many supplies you need.

**Table 3–1. Workstation Power Codes**

| Device Type             | Device *                                         | Power Code |
|-------------------------|--------------------------------------------------|------------|
| Processor Units †       | B28/B38                                          | 4          |
|                         | EXP                                              | 5          |
|                         | GXL                                              | 6 ‡        |
| Memory Expansions       | B28-1MB                                          | 0.25       |
| Graphics Modules        | All                                              | 2          |
| Disk Modules            | XS6                                              | 2          |
|                         | M0, M1, MS5, MS6, MS9, XS7, XS8, XSA             | 3          |
|                         | CX5, CX6, MF1, MS7, MS8, MSA, MX3, MX4, MX5, MX6 | 4          |
|                         | M3, M4, M5, MC5, MC6, MU5                        | 6          |
|                         |                                                  |            |
| Tape Modules            | DDS                                              | 2          |
|                         | TS, TS2                                          | 5          |
| Communications Modules  | DCX                                              | 1          |
|                         | DN2                                              | 2          |
|                         | EN3, ID2, IDS, TR2                               | 3          |
| Special-Purpose Modules | TEL                                              | 1          |
|                         | PEM                                              | 1.5        |
|                         | CDX, 1PC                                         | 2          |
|                         | CDC                                              | 3          |
| Monitors                | CA1, GS1                                         | 1          |
|                         | D1, D2, D5, D6, PD7                              | 3          |
|                         | PD8                                              | 4.5        |

\* The B25 prefix has been omitted from all module titles for clarity. Devices that do not appear in the table have a power code of 0.

† B39 processor units have internal power supplies and, thus, plug directly into the wall. LCW processor units also plug directly into the wall unless the system includes a B25-PD8 monitor. In this case, you must use a B25-PS power supply to connect the processor unit to the wall.

‡ This power code accommodates an X-Bus card. If you do not plan to install an X-Bus card, calculate the power code as 5 instead of 6.



### Power Supply Placement

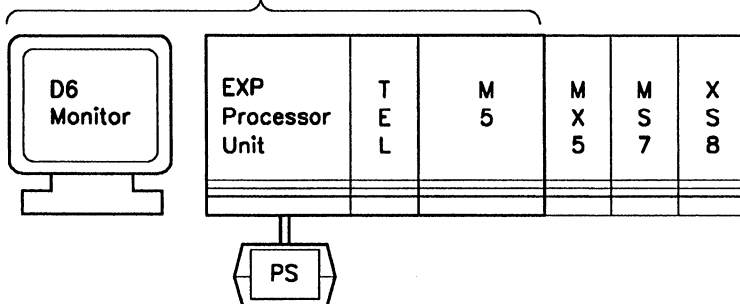
Power supplies plug into power receptacles at the back of your modules and processor unit (except the B39). As you arrange your power supplies, you need to determine the appropriate connection points for your configuration. The following guidelines summarize the basics of power supply placement. After you read this discussion, you should know precisely how many power supplies you need and where to place them.

#### B28/B38, EXP, and GXL Families

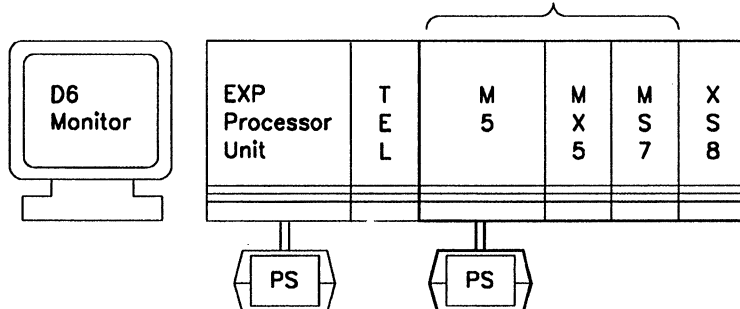
To configure your power supplies, perform the following procedure. For more information, see the paragraph entitled “Setting Up Workstation Power” in the *Hardware Installation Guide* for your processor unit.

- B25-PS power supplies – Complete the following steps:
  1. Connect the first power supply to your processor unit (see Figure 3–9).
  2. Add the monitor power code to the processor unit power code.
  3. Working your way down the string, add the power code of each module to the combined processor unit/monitor power code.
  4. When the sum exceeds 10, connect a power supply to the module that caused the overflow. If the module does not have a power receptacle, attach the power supply to the module immediately before it.
  5. Starting with the module that just received the power supply, work your way down the string, adding the power code of each module.
  6. When the sum exceeds 10, connect a power supply to the module that caused the overflow. If the module does not have a power receptacle, attach the power supply to the module immediately before it.
  7. Repeat steps 5 and 6. Continue in this fashion until you reach the end of the module string.
- B25-PS1 power supplies – Perform the procedure just described using a factor of 15 rather than 10 in steps 4 and 6. Be careful when you look at Figure 3–9; this figure is valid for B25-PS power supplies only.

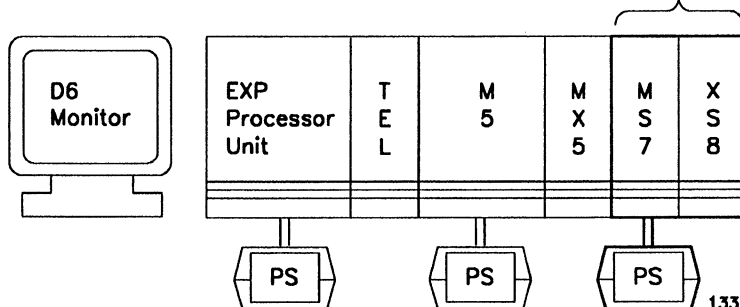
Power Code = 3 + 5 + 1 + 6 = 15



Power Code = 6 + 4 + 4 = 14



Power Code = 4 + 3 = 7



133,3-9

Note: The B25 prefix is omitted from the device names for clarity

**Figure 3-9. Power Supply Placement for B28/B38, EXP, and GXL Processor Units**

### B39 Family

B39s incorporate an internal power supply that services the processor unit. If your monitor is directly connected to your processor unit (no graphics module), the internal power supply services the monitor as well.

In most respects, B39 workstation power planning is the same as B28/B38, EXP, or GXL power planning (see the previous paragraph for a description). However, you should note the following differences:

- When you configure B39 power, connect the first power supply to the module immediately after the processor unit. Start the power code count from this module.
- Make sure to **exclude** the monitor power code unless the monitor attaches to a graphics module; in this case, add the monitor power code to the graphics module power code.
- If you are looking at Figure 3–9, be careful; this figure is not valid for B39 processor units because the B39 processor unit does not receive a power supply.

### LCW Family

LCWs also incorporate an internal power supply that services the processor unit and monitor. Only LCW workstations that include a B25-PD8 monitor require an external power supply. In this case, you connect the power supply to the processor unit.

### AC Outlets

You need one electrical outlet for each workstation component that uses an ac line cable. These components include B39 processor units, LCW processor units, power supplies, and certain peripherals. If you are short of outlets, you can connect two B25-PS power supplies together. In this case, only one of the supplies requires an ac outlet. For more information see the *Hardware Installation Guide* for your workstation.

If you connect more than one workstation to an outlet (for example, through a power strip), make sure that the combined current for the workstations does not exceed the maximum current rating for the outlet.

## Surge Protection

Electrical surges can damage computer equipment. Surges can occur during lightning storms and immediately after a power outage. Some facilities experience regular power surges due to the nature of their electrical system.

If your electrical system experiences periodic power surges, consider installing surge protectors for each workstation. United States users can order surge protectors from the *Unisys Supply Catalog* as part number 57-8960-874 (3-plug model) or 57-8966-871 (6-plug model); international customers should call their service representative.

In geographic areas prone to lightning storms, you should also install lightning surge protectors for any network cables that run outside of the building. Lightning surge protectors minimize system damage from voltage surges that occur during lightning storms. For lightning surge protectors to operate correctly, you must install one at each end of the outdoor cable run. If you need more information on lightning surge protectors, see the *Unisys Building Wiring Guide*.

**Note:** *Lightning surge protectors rarely withstand direct lightning strikes; they are often damaged during nearby lightning strikes.*

## Sample Workstations

Now that you are familiar with the basics of configuration, consider the following three examples. These three configurations represent correctly configured workstations. Each workstation is configured for a specific application, and each meets the needs of a different user. Remember that these are only samples. Your configuration will undoubtedly differ in some respects. To see how the workstations are physically arranged, review Figure 3–10.

### *High-performance server*

This workstation maximizes storage capacity and data access. The processor unit chosen for this application is the fast and powerful B38-GXL, which incorporates internal graphics control circuitry. The processor unit is attached to an intelligent data communications module and an Ethernet LAN module, furnishing a server-to-server link. These two X-Bus modules are followed by a wide range of SCSI storage modules featuring a floppy/hard disk upgrade and tape expansion to take care of any archiving needs. Also included are a full group of SCSI hard disk expansions that provide bulk data storage and a CD-ROM expansion for compact disc applications. This configuration is typically used as a server rather than a cluster workstation.

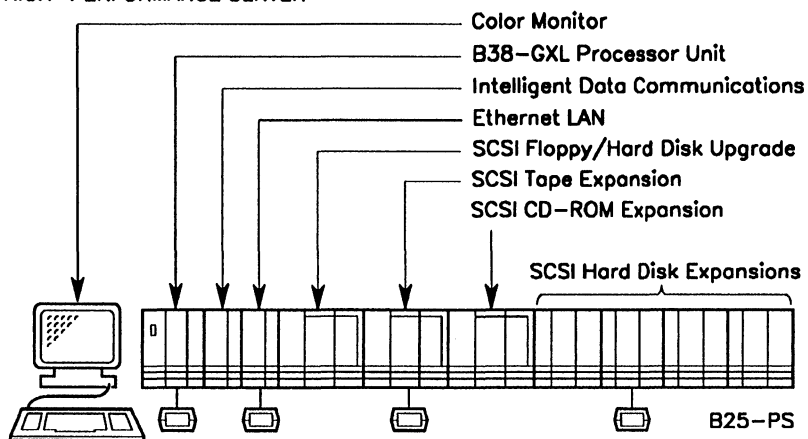
### *Graphics workstation*

This workstation is customized for applications that require graphic output. Again, the B38-GXL is the chosen processor unit. The processor unit's internal circuitry provides video and graphics capabilities for the high-resolution color monitor. The workstation is equipped with a mouse for graphics applications. The SCSI floppy/hard disk upgrade provides archiving capabilities while the SCSI hard disk expansion allows enough storage space for any large graphics file. An artist typically selects this type of configuration.

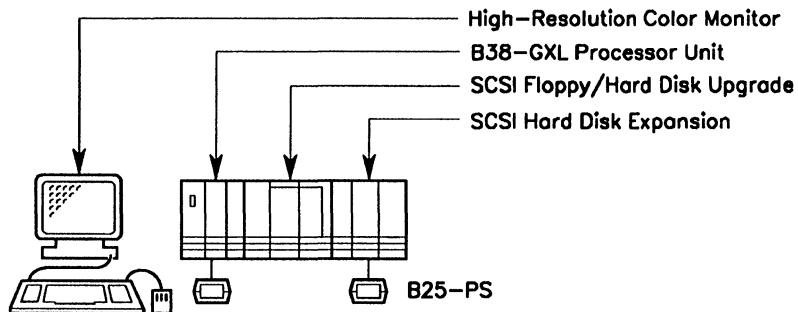
### *Compact workstation*

This workstation represents a minimum configuration; it includes only an LCW processor unit, a keyboard, and a monitor. Configurations of this sort are always cluster workstations; they must be attached to a server to access files and programs. The compact workstation is a good choice where office space is an issue.

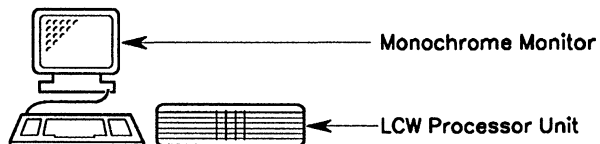
## HIGH-PERFORMANCE SERVER



## GRAPHICS WORKSTATION



## COMPACT WORKSTATION



133.3-10

Figure 3-10. Sample Workstations

### Where to Go From Here

In this section, you learned how to configure your hardware and ensure that your workstation has enough power sources. You should now feel confident with the following tasks:

- You should be able to configure both the X-Bus and the SCSI bus.
- You should know where to place each module in relationship to the rest of the modules in the string.
- You should know how many power supplies your workstation needs.
- You should be able to determine which devices in your configuration receive power supplies.

When you are ready, turn to Section 4. This section tells you about clusters and networks. You may find that some of the information in Section 4 alters the configuration you developed while reading Section 3. If this is the case, adjust your plan accordingly.

## Section 4

# Clusters and Networks

Section 4 introduces you to clusters and networks. This section gives you an idea of what clusters and networks look like as well as how they operate. Section 4 also identifies some of the planning issues you should consider when you are installing a cluster. If you are working with the equipment for the first time, read this section thoroughly before beginning your installation. Section 4 covers the following topics:

- Special note
- Clusters
  - Planning
  - Number of workstations
  - Cluster connection methods
- Combined clusters
- Networks
  - LANs
  - LAN technologies
- Combined networks

### Special Note

The subject of cluster and network installation is a complex one. If you are installing a cluster or network, you need to pay careful attention to system software as well as hardware. Since these subjects are fully covered in other manuals, this guide provides only a brief overview of cluster or network planning. For details on clusters and networks, see the following publications:

- *CTOS System Administration Guide*
- *CTOS Cluster and Network Hardware Installation Guide*

### Clusters

A cluster is a configuration that links several workstations together. If you look at various clusters, you will notice differences in the number of workstations that form the cluster, the hardware they feature, and the applications they support. However, you will find that **all** clusters contain one server and one or more cluster workstations. These terms are defined as follows:

|                            |                                                                                                                                                                                                                                                                       |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Server</i>              | The server is the central workstation for the cluster. It runs cluster programs, provides data storage, furnishes shared access to printers, and so on. Typically, servers are powerful workstations, equipped with a wide range of modules.                          |
| <i>Cluster workstation</i> | A cluster workstation is a workstation that relies on the server for special functions (for example, file access, shared utilities, and so forth). Cluster workstations usually have fewer modules than the server. They often feature less powerful processor units. |

## Cluster Planning

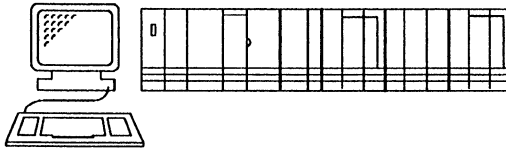
As you plan your cluster, think about the tasks that each cluster user performs. With this in mind, try to develop a scheme that makes efficient use of the hardware. For instance, if your users all access the same group of files, you can store these files on server disks, eliminating the need for hard disks on each cluster workstation.

Here are some suggestions that will help you determine the best layout for your cluster. To give you an idea of the clustering possibilities, Figure 4-1 shows a sample cluster configuration. Remember, your cluster will undoubtedly differ from this example.

- Select the fastest, most powerful processor unit as your server. For example, if your cluster includes both B28 and B39 processor units, use the B39 processor unit as your server.
- **Always** attach at least one disk module to your server. This module acts as a central storage point for the cluster. If your cluster handles large amounts of data, the server may need more than one disk module.
- Some users work primarily with common files that are stored on the server. These users often do not require disk modules for their cluster workstation.
- Some users work mainly with their own files. If these files are not typically accessed by the group, attach one or more disk modules to the user's cluster workstation. These disk modules are for the cluster workstation's use only.
- If several members of your cluster access CD-ROM or tape modules, attach these modules to the server. When you attach CD-ROM and tape modules to a cluster workstation, only the owner of that workstation can access them.

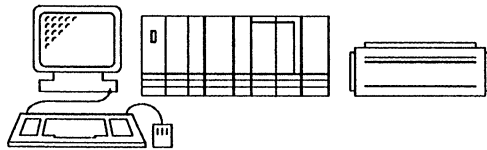
- **Attach the following modules to every workstation that needs them. Cluster workstations cannot access these functions from a server.**
  - **All graphics modules**
  - **IBM PC Emulator modules (B25-1PC)**
  - **Peripheral extension modules (B25-PEM)**
  - **Voice Processor modules (B25-TEL)**
  - **Four-port data communications modules (B25-DCX)**
  - **Intelligent data communications modules (B25-ID2 and B25-IDS)**
- **Attach LAN modules (B25-EN3 and B25-TR2) to the server *only*.**
- **If you plan to connect the cluster to a WAN, configure a B25-DCX, B25-DN2, B25-ID2, or B25-IDS module for the server. As an alternative, you can install a B25-DN1 X-Bus card for the server.**
- **All cluster users can access each cluster printer regardless of which workstation the printer is attached to. If the cluster has more than one printer, attaching the printers to separate workstations reduces the load on the server.**
- **Remember that you can work from a server just as you would any other workstation.**

## SERVER

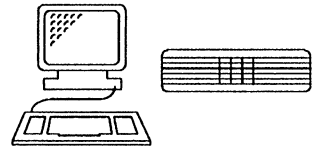


B39 Processor Unit  
Graphics Controller X-Bus Card  
Ethernet LAN Module  
SCSI Disk Modules  
SCSI Tape Expansion Module  
Monitor  
Keyboard

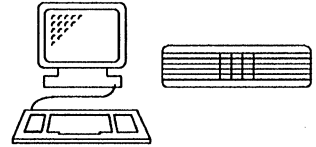
## CLUSTER WORKSTATIONS



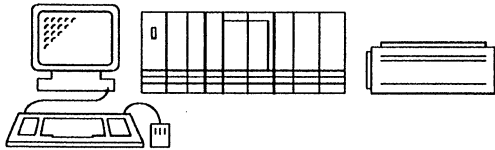
B28 Processor Unit  
Graphics Module  
Floppy/Hard Disk Module  
PC Emulator Module  
High Resolution Monitor  
Keyboard and Mouse  
Printer



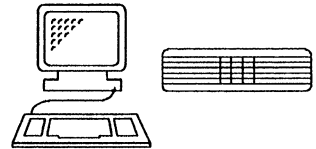
LCW Processor Unit  
Monitor  
Keyboard



LCW Processor Unit  
Monitor  
Keyboard



B38-EXP Processor Unit  
Graphics Controller X-Bus Card  
SCSI Disk Modules  
Color Monitor  
Keyboard and Mouse  
Printer



LCW Processor Unit  
Monitor  
Keyboard

133.4-1

**Figure 4-1. Sample Cluster**

### Number of Workstations per Cluster

The number of workstations you can attach to your server depends on several factors. The most important of these is the type of processor unit you select as a server. You may find the following guidelines handy as you configure your cluster.

**Note:** *These guidelines define the recommended limits for various servers. However, for some applications, you may achieve better performance with fewer cluster workstations.*

- B28 series, B28-EXP, and B28-EX1 processor units support up to 12 cluster workstations.
- B38 series, B38-EXP, B38-GXP, and B38-GXL processor units support up to 16 cluster workstations.
- B39 processor units support up to 24 cluster workstations when **all** the processor units in the cluster are from the following group:
  - B28-EV/MEV processor units
  - B38-EV/MEV processor units
  - B39 processor units
  - EXP processor units
  - GXL processor units
  - LCW processor units

If you have **any** different processor units, you can configure a maximum of 16 cluster workstations.

Other factors that may affect the server's clustering capabilities are the type of operating system and the number of diskless workstations. For more information, see the *CTOS System Administration Guide*.

## Cluster Connection Methods

You can cable your cluster using one of two connection schemes: TeleCluster or RS-422/485 cabling. In either case, the attachment point is always the processor unit; you **never** connect cluster cabling to a module or monitor. To familiarize you with the two connection schemes, the following discussion outlines the differences between TeleCluster and RS-422/485 cabling.

*TeleCluster*      TeleCluster technology relies on a device called a TeleCluster hub to transmit data between the members of the cluster. In this type of cluster, each workstation is connected to the hub through a TeleCluster adapter. The adapter converts the workstation's transmissions and forwards them to the hub via twisted-pair wire (telephone wire, or the equivalent). The hub acts as the central connection point for the cluster, sequencing all cluster work flow. Figure 4-2 shows you a TeleCluster configuration.

*RS-422/485 cabling*      RS-422/485 clusters use direct system-to-system cabling. In this type of cluster, the first workstation in the cluster is connected to the second workstation in the cluster. This workstation, in turn, is connected to the third workstation, and so on. This connection scheme is known as a daisy chain. You may place the server anywhere in the daisy chain. For electrical continuity, you must terminate both ends of the daisy chain with a device called a *terminator*. All cables used to form the daisy chain are RS-422/485 cables. To look at an example, see Figure 4-2.

The clustering method that you select depends on the layout of your cluster, the physical characteristics of your workplace, and the movement patterns of the work force. Although you probably have selected your clustering method already, the following discussion reviews some of the criteria that planners use in deciding between RS-422/485 clusters and TeleClusters.

### **TeleCluster Configurations**

- Chosen when the server and cluster workstations are far apart.
- Chosen when cable routing between workstations is difficult or when physical barriers are present.
- Chosen for dynamic office environments where employees frequently switch offices.

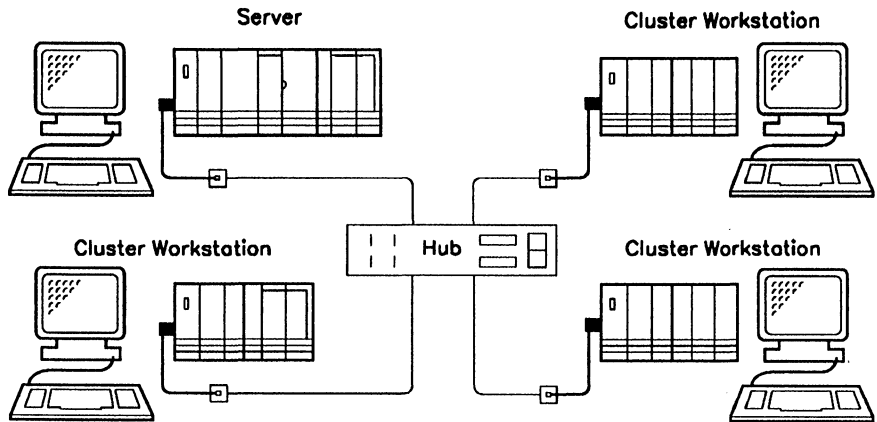
### **RS-422/485 Configurations**

- Chosen when the server and all cluster workstations are close to each other.
- Chosen when cable routing between all workstations is direct and easily installed.
- Chosen for stable office environments where employees occupy the same offices for long periods of time.

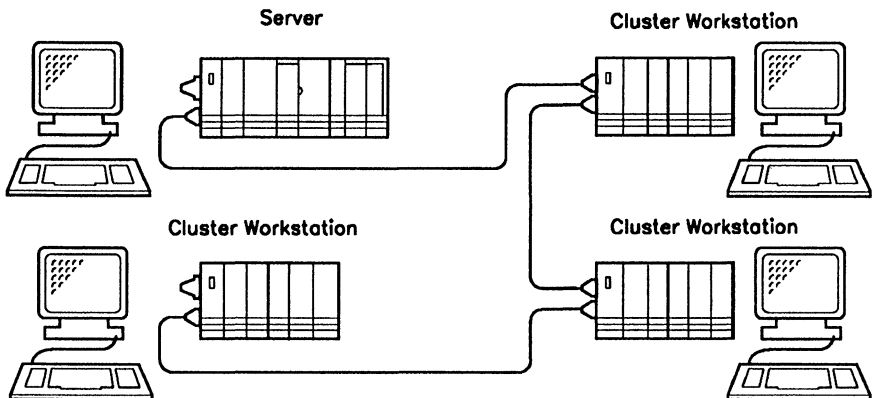
Both TeleCluster and RS-422/485 technologies set specific limits on cable length. For RS-422/485 clusters, there are also restrictions concerning the kind of terminators you use. These rules are a product of which kind of cable you choose, the cable configuration, and so forth. As you plan your cluster, pay close attention to these rules. For details, see the *CTOS Cluster and Network Hardware Installation Guide*.

If you are installing a TeleCluster configuration or a large RS-422/485 cluster, you may need the assistance of specially trained personnel to route the cables, install the hubs, and so on. Plan on contacting a cable installer, a building contractor, or, for TeleCluster configurations, a telephone specialist. Do not attempt the cabling on your own.

## TELECLUSTER CONFIGURATION



## RS-422/485 CONFIGURATION



- ◁ = Terminator (Install in the processor unit)
- = TeleCluster Adapter (Install in the processor unit)
- = TeleCluster Jack

133.4-2

**Figure 4-2. Cluster Configurations**

### Combined Clusters

Some clusters feature a combination of TeleCluster and RS-422/485 technologies. These clusters typically have one or more short segments connected by RS-422/485 cable; each segment includes four workstations or less. The first workstation in each segment is connected to a TeleCluster configuration through a TeleCluster adapter. In this type of configuration, only the last workstation in the segment receives a terminator.

### Networks

You can configure your server for attachment to a network. Networking results in extremely powerful data processing environments, where each workstation has access to extensive system resources. The B2X/B3X family supports two kinds of networks: local area networks (LANs) or wide area networks (WANs). The most obvious difference between a LAN and a WAN is that WANs can transmit data further than LANs. The following discussion provides a brief review of LAN technology.

**Note:** *Since they are less frequently installed than LANs, this discussion does not cover WANs; for information on WANs, see the CTOS Cluster and Network Hardware Installation Guide.*

### LANs

A LAN is a configuration in which several servers are linked together. You can configure different types of servers on the same LAN. In other words, some of your servers may be B2X/B3X processor units while others may be from different processor unit families (for example, the XE-530). If a server is connected to a LAN, all of its cluster workstations can communicate with any other workstation on the network.

To develop a LAN, you need to carefully study such factors as network usage, work load, line noise, and layout. Each of these factors can have a profound bearing on the performance of your LAN. For example, the number of servers that your LAN can effectively handle depends on how heavily you utilize the network. If your network runs only a few applications, you may be able to configure over 100 servers. On the other hand, if network members access shared resources continuously, 10 servers may be a more effective choice.

Because the way you plan your network varies with the needs and constraints of your particular environment, this topic is not covered in the *Planning and Owner's Maintenance Guide*. However, you can get acquainted with LAN fundamentals by reading the following general overview.

**Note:** For specifics on LAN cable lengths and configurations, see the CTOS Cluster and Network Hardware Installation Guide.

### LAN Technologies

LAN configurations are based on either of two technologies: Ethernet or token ring. These two approaches utilize different equipment and *topologies*, or connection schemes. Remember that a server can be part of more than one network (see “Combined Networks,” later in this section).

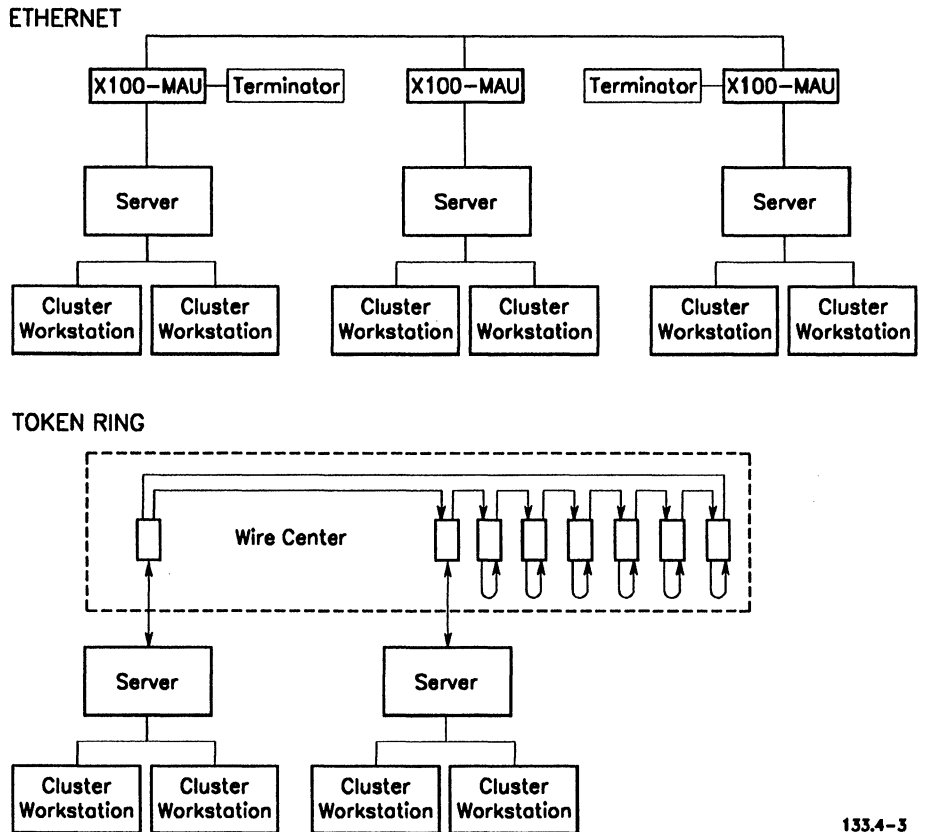
#### Ethernet LANs

Ethernet LANs use bus topology as their connection scheme. In bus topologies, a common bus transmits sets of data, or *packages*, back and forth to the appropriate network members. Ethernet LANs have fast turnaround times because they eliminate unnecessary waiting time (in other words, channel overhead).

In Ethernet configurations, each server must include an Ethernet LAN module (B25-EN3) or its equivalent. This module is cabled to the bus through an X100-MAU (Medium Attachment Unit). The X100-MAU acts as the interface between the Ethernet bus and the server. For Ethernet LANs, the X100-MAU is sometimes called a *node*. Figure 4–3 illustrates a simple Ethernet LAN.

You can expand your Ethernet configuration by connecting several simple networks like the one just described. The result is a large, complex network. Expanded networks utilize a device called a *repeater*. Repeaters are data transmission units manufactured by a number of commercial sources. These devices connect one simple network to another, providing signal amplification and retiming. In this type of configuration, the simple networks are called *segments*. The repeaters and associated cables are called *links*.

**Note:** *When you install an Ethernet LAN, make sure to place a terminator at both ends of each segment. You should include both terminators even if you are using repeaters to connect the segment to a complex network.*



133.4-3

**Figure 4-3. Basic Network Configurations**

### Token Ring LANs

Token ring LANs use ring topology instead of bus topology. In this case, each server is connected to the next. The first and last server are also connected together, forming a ring. When a token ring network is idle, the logic sends a token around the ring. If a server does not need to transmit data, it passes the token to the next server in the ring. As soon as the token reaches a server that is ready to transmit, the server keeps the token and sends the package. Only when the transaction is complete does the server release the token to the next server. This approach prevents transaction conflicts in the network.

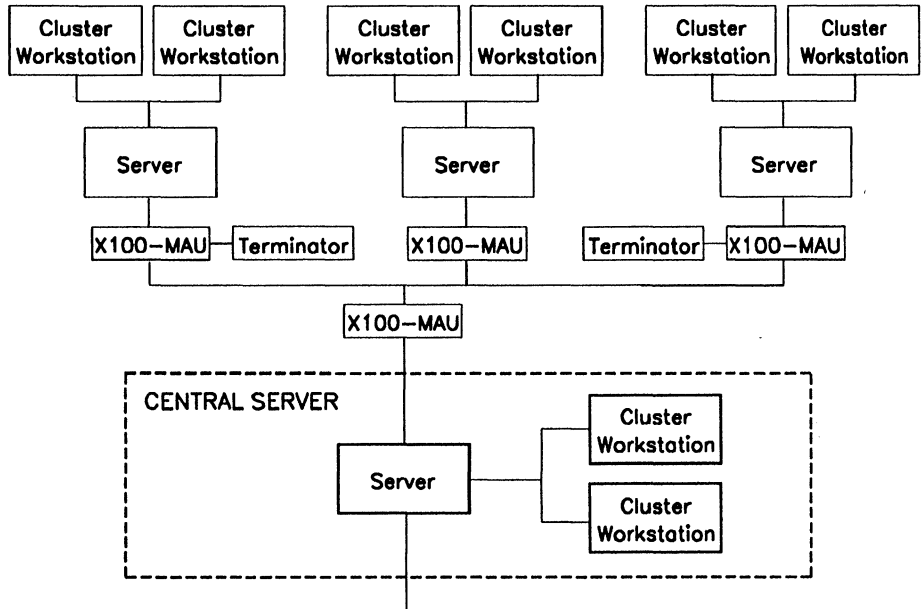
In token ring configurations, each server must include a token ring LAN module (B25-TR2) or its equivalent. This module is cabled to a wire center that supports eight servers. The wire center acts as the meeting point for the servers in the ring. Through this mechanism, you connect each server to the next. Figure 4-3 shows you a simple token ring.

Like Ethernet LANs, token ring LANs can be expanded into complex networks. To expand a token ring LAN, you connect one wire center to another and the last wire center to the first. In this case, the wire centers themselves form a ring, much as the servers in an individual token ring.

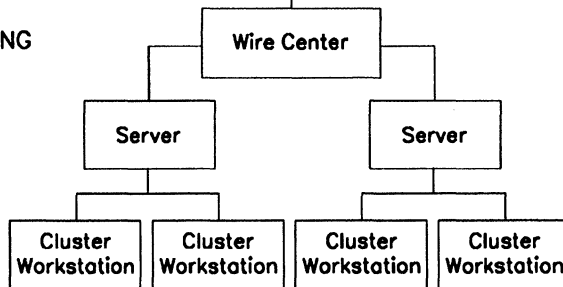
## Combined Networks

If you want your server to be part of more than one network, you can combine Ethernet LANs, token ring LANs, and WANs. To configure this type of network, you use a star topology. With star topologies, all members of the star are individually connected to a central server. The central server acts as a clearing house for all data transactions, providing its own cluster workstations access to both networks. In a combined network, the central server is configured with both token ring and Ethernet LAN modules. If you plan to connect a WAN to the central server, you need to configure a B25-DCX, B25-IDS, B25-ID2, or B25-DNZ module for the server. As an alternative to the B25-DNZ, you can use a B25-DN1 X-Bus card. To look at an example of a combined network, see Figure 4-4.

ETHERNET



TOKEN RING



133.4-4

Figure 4-4. Combined Network Configurations

# Where to Go From Here

In this section, you learned how to configure a cluster. You also learned about the two types of LANs. You should now feel confident with the following tasks:

- You should understand which modules you need to configure for your server and which modules must be included in the cluster workstations.
- You should be able to adjust your workstation plan accordingly.
- You should know which kind of cluster connection scheme (TeleCluster or RS-422/485) your cluster uses.
- You should be able to tell whether your server is part of a network. If it is, you should also know the type of network.

When you are ready, turn to Section 5. This section guides you through the physical aspects of installation planning. For example, Section 5 explains how to calculate the dimensions of your workstation.

# Section 5

## Preparing for Installation

Section 5 covers several practical issues you should bear in mind as you prepare your installation site. This section also explains how to safely handle the devices in your workstation. Remember, workstations located in a clean, stable environment operate more efficiently. If you are working with the equipment for the first time, read this section thoroughly before beginning your installation. Here are the topics covered in Section 5:

- Site preparation
- Equipment placement
  - Physical placement
  - Calculating space requirements
  - Distance factors
  - Workstation comfort
- Preliminary procedures
  - Equipment records
  - Media defect records
- Safety
  - Precautions
  - Equipment handling

### Preparing the Site

For your equipment to operate properly, its immediate surroundings must comply with certain environmental and electrical specifications. Most installation sites already meet these specifications. However, just to make sure, spend a moment reviewing the specifications in Appendix A. As you read these specifications, think about the following points:

**Note:** *If you do not comply with the guidelines in Appendix A, your workstation can experience performance problems and reduced reliability.*

- The specifications in Appendix A tell you what temperature the room should be while the equipment is operating. Small rooms that contain several workstations can heat up past these limits once you turn on all the equipment. If you have this problem, you **must** turn up your air conditioning system so that the room stays within the specified temperature range. Check with your facility engineer to ensure that your air conditioning system can support the extra load.
- Disk and tape storage modules are sensitive to sudden temperature and humidity changes. If the room you select for your workstation undergoes rapid climate changes, you **must** adjust your climate controls to minimize these changes.

## Where to Put Your Equipment

The location of your workstation can affect how well it performs and how comfortably it serves you. The following guidelines promote effective workstation usage. Pay close attention to the rules concerning physical placement. If you choose a site that does not adhere to these guidelines, your workstation can experience problems.

### Physical Placement

The strength of your work surface, the amount of vibration, and the amount of air space surrounding your equipment can affect workstation performance. Before you position your equipment, consider the following:

- Choose a desk or some other open surface as the location for your processor unit and modules. Whatever surface you select, **be sure** that it can support the combined weight of your processor unit, modules, and any other equipment it is commonly used for.  
***Note:** B39 processor units and their attached modules are typically heavier than other configurations. Most shelves cannot safely support B39 configurations.*
- If you decide to stack your monitor on top of your processor unit and modules, ensure that your work surface can support the equipment.
- Do **not** place your workstation on the same surface as your printer or any other device that vibrates. Excessive vibration can damage high-performance hard disks and loosen workstation connections.
- Leave **at least** 4 in. (10.2 cm) of space behind the processor unit and module string. Make sure that this area is clear of debris (papers, pencils, and so forth). Ensure that nothing blocks the fan vents.
- Leave **at least** 3 in. (7.6 cm) of space in front of the processor unit and module string. Make sure that this area is clear of debris and that nothing blocks the air vents.

## Preparing for Installation

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- Do **not** place objects (papers, books, and so forth) on top of the processor unit, monitor, or other devices.
- **Never** put your workstation in a drawer. Do **not** place it on a shelf that restricts airflow. Do not place your workstation in a closed cabinet.
- If you place your workstation on a shelf, make sure to leave at least 6 in. (15.2 cm) of air space above the workstation to prevent overheating.
- Do not place the processor unit and modules in a location where they can collect dirt and debris (the floor, for example).
- **Never** place your equipment in a location that receives direct sunlight.
- Make sure that the room you choose has enough electrical outlets for your equipment. Overloading a single outlet can cause electrical problems.

## Calculating Space Requirements

To help you calculate how much space your workstation needs, here is some information on the height, width, and depth of the equipment. When you perform your calculations, remember to add space at the front, rear, and top of your equipment as described in “Physical Placement,” above.

- Your processor unit and modules are generally 8 in. (20.3 cm) high.
- Your processor unit and modules are generally 12 in. (30.5 cm) deep. However, some modules include a connector extension panel at the rear of the module. This panel increases the overall depth of the module. When you add the 4 in. (10.2 cm) clearance at the back of the string, make sure that you measure from the end of the panel rather than from the end of the module cabinet.

- The widths of your processor unit and modules vary. You add these widths to determine the overall length of your workstation. When you calculate the length, use the dimensions in Table 5–1; these dimensions can also help you calculate X-Bus length. If you like, you can use the form in Figure 5–1 to perform these calculations.
- LCW processor units have the following dimensions:
  - Height: 3.3 in. (8.9 cm)
  - Width: 12.7 in. (32.3 cm)
  - Depth: 15 in. (38.1 cm)
- The dimensions of your monitor and keyboard vary depending on the model you select. Because there are so many different keyboards and monitors, this guide does not provide individual measurements. However, as a general guideline, the maximum dimensions for Unisys monitors and keyboards are:

### **Monitors**

- Height: 15 in. (38.1 cm)
- Width: 15.6 in. (39.6 cm)
- Depth: 18 in. (45.7 cm)

### **Keyboards**

- Height: 2.6 in. (6.6 cm)
  - Width: 20.3 in. (51.6 cm)
  - Depth: 9 in. (22.9 cm)
- If you have a B39 processor unit, leave some room at the left side so that you can reach the reset switch.
  - If you have a mouse, MCR, or PIN keypad, be sure to leave enough room on your desk.
  - In the rare event that you are installing the B25-FXC or any module that has a B27 prefix, refer to the *BTOS Hardware Installation Guide* for the dimensions of these modules.

## Preparing for Installation

| <b>Workstation 1</b> |                   | <b>Workstation 2</b> |                   |
|----------------------|-------------------|----------------------|-------------------|
| <b>Equipment</b>     | <b>Unit Width</b> | <b>Equipment</b>     | <b>Unit Width</b> |
| Processor Unit:      |                   | Processor Unit:      |                   |
|                      |                   |                      |                   |
| Modules:             |                   | Modules:             |                   |
|                      |                   |                      |                   |
|                      |                   |                      |                   |
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|                      |                   |                      |                   |
|                      |                   |                      |                   |
| Total:               |                   | Total:               |                   |

### Figure 5–1. String Length Worksheet

**Table 5–1. Processor Unit and Module Width**

| Device Type             | Device *              | Width              |
|-------------------------|-----------------------|--------------------|
| Processor Units †       | B28/B38, EXP, and GXL | 6 in. (15.2 cm)    |
|                         | B39                   | 13.9 in. (35.3 cm) |
| Graphics Modules        | All                   | 2.7 in. (6.9 cm)   |
| Disk Modules            | MX3, MX4              | 2.7 in. (6.9 cm)   |
|                         | All Others            | 5.8 in. (14.7 cm)  |
| Tape Modules            | All                   | 5.8 in. (14.7 cm)  |
| Communications Modules  | DCX, DN2              | 2.7 in. (6.9 cm)   |
|                         | EN3, ID2, IDS, TR2    | 3.9 in (9.9 cm)    |
| Special-Purpose Modules | 1PC, PEM, TEL         | 2.7 in. (6.9 cm)   |
|                         | CDC, CDX              | 5.8 in. (14.7 cm)  |

\* The B25 prefix has been omitted from all module titles for clarity.

† LCWs are not connected to modules so they are not included in this table.

## Distance Factors

Many of the devices in your workstation are connected to your processor unit and module string via cables. The length of these cables determines how far apart you can place the devices in your workstation. Cable length also governs the distance between the workstation and the power outlets. To help you calculate distances, here are the lengths of the most common workstation cabling. For cluster and network cable lengths, see the *CTOS Cluster and Network Hardware Installation Guide*.

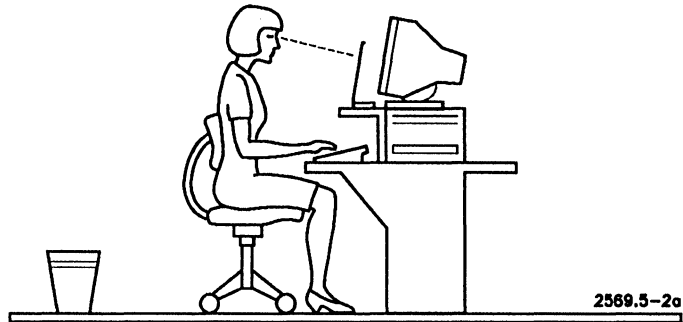
| Cable                                        | Length                     |
|----------------------------------------------|----------------------------|
| Power supply to wall                         | 10 ft. (3.1 m)             |
| Power supply to processor unit or modules    | 6.25 ft. (1.9 m)           |
| Monitor to processor unit or graphics module | 16 ft. (4.9 m)             |
| Keyboard to monitor                          | 14 in. (35.6 cm), coiled   |
| Keyboard to GXL processor unit               | 38.7 in. (98.5 cm), coiled |

### Promoting a Comfortable Workplace

The more comfortable you are with your workstation, the more effectively you use it. Physical factors like room lighting, seat height, and posture can affect your level of comfort. Before you install your equipment, take a few moments to think about whether the location you have chosen will make your workstation easy to use. Here are a few suggestions:

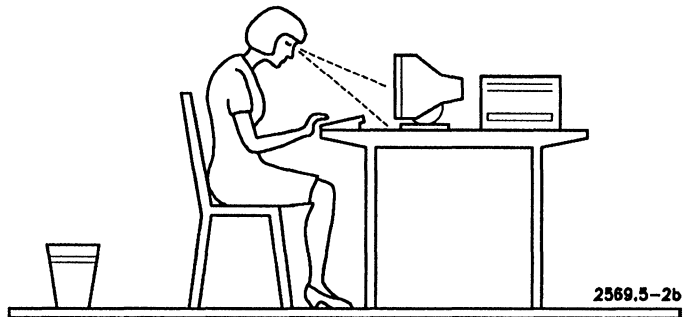
- Turn to Figure 5-2 and study the difference between a properly placed monitor and one that is poorly positioned.
- Position your monitor so that you can look directly at the screen. If you place your monitor at an angle to your seat, find a chair that swivels and turn to squarely face your monitor each time you use it.
- Make sure that your screen is parallel to your plane of vision; keep the screen clean.
- Make sure that your screen is a comfortable distance from your eyes. If your screen is too close or too far away, you may experience eyestrain.
- To reduce eyestrain, you should look away from your screen periodically and focus on a distant object. This measure will be easier if you orient your screen so that you face an open area.
- Before you attach any cables, sit in front of your monitor and adjust the screen angle to reduce glare. Make sure to keep backlighting at a minimum.
- If the height of your monitor needs to be changed, do it before you cable the equipment.
- If your monitor and application let you select the type face, choose an easy-to-read font and character size. Fonts that have serifs are easier to read than ones without serifs.
- Make sure the screen brightness and contrast are properly adjusted.
- If your workstation includes tape modules, CD-ROM modules, or floppy disk modules, make sure that they are easy to reach.

## CORRECT WORKSTATION SETUP



- The user's neck and upper back are straight.
- The chair is adjustable and firmly supports the user's lower back.
- The document is close to screen height and in the user's line of sight.
- The monitor is at an easy viewing height, and the table is at the right height for typing.
- The keyboard is at the correct height in relationship to the user's arms.

## INCORRECT WORKSTATION SETUP



- The user's neck and upper back are bent because the screen and document are too low.
- The chair is not adjustable, it does not support the lower back, and it is not cushioned.
- The document is not in the same line of sight as the screen.
- The keyboard is too high, and the user's wrists are not supported.
- The table is too high for comfortable typing.

**Figure 5-2. Arranging Your Work Space**

# Getting Ready

If you are reading these instructions, we assume you have already found your processor unit carton and removed your manuals. As you get ready to unpack the rest of your equipment, make a record of the hardware you receive. If your workstation includes hard disk modules, you should also complete some paper work on their media defect history. The following paragraphs tell you about performing an equipment inventory and recording your media defects.

## Workstation Inventory, Sorting, and Record Keeping

Your equipment arrives in individual cartons. These cartons are grouped together and placed in a large container or strapped to shipping pallets. If you received a large container, remove the individual cartons. For pallet shipments, make sure that you have clipped the straps on each pallet and removed the shrink wrap. Next, lift the individual cartons off the pallet. In either case, **make sure** you have someone help you lift heavy cartons.

**Note:** *Do not unpack the individual equipment cartons at this time. You will unpack these cartons when you install your workstation (see the Hardware Installation Guide for your workstation).*

As you remove the cartons from the container or pallet, take an inventory of the items you received. Figure 5–3 provides an inventory worksheet for your use. To complete the form, perform the following steps:

1. Copy the form. Fill out the location and installation date at the top of the form.
2. Indicate whether the workstation is a server or a cluster workstation by checking the appropriate box.
3. Indicate the device characteristics in the “Device” column. For example, if you have a graphics controller X-Bus card, write “graphics controller” under the “X-Bus Cards” heading.

When the inventory is complete, check it against the original order to make sure that all of your equipment has arrived. Be sure the inventory matches your configuration plan. If you are installing more than one workstation, sort the cartons into groups according to the individual workstation plans.

Server: ☐ Cluster Workstation: ☐  
Location (Room Number): \_\_\_\_\_  
Installation Date: \_\_\_\_\_

Hardware Inventory

| Device                             | Style or Model Number | Serial Number |
|------------------------------------|-----------------------|---------------|
| Processor Unit:                    | _____                 | _____         |
| Memory Expansions:                 | _____                 | _____         |
| X-Bus Cards:                       |                       |               |
| _____                              | _____                 | _____         |
| _____                              | _____                 | _____         |
| _____                              | _____                 | _____         |
| Monitor:                           |                       |               |
| _____                              | _____                 | _____         |
| Keyboard:                          |                       |               |
| _____                              | _____                 | _____         |
| Mouse and/or Magnetic Card Reader: |                       |               |
| _____                              | _____                 | _____         |
| _____                              | _____                 | _____         |

Figure 5–3. Inventory Worksheet (Part 1 of 2)

.....

[illegible]

**Figure 5–3. Inventory Worksheet (Part 2 of 2)**

## Media Defect Records

All hard disk modules undergo extensive testing before they leave the factory. These tests locate flaws, or *defects*, on the surface of the media. SCSI logic keeps a record showing the location of each defect and automatically skips over the area so that you do not experience media problems. With X-Bus hard disks, you may need to manually enter the location of each defect when you initialize the drive. The logic then adjusts for the defects as it formats the disk.

So that you can complete this task, each X-Bus hard disk module has a label listing the media defects; Figure 5-4 shows you an example. You can find this label on the underside of the module. When you unpack your workstation, make a separate record of the media defects and file it with your hardware inventory. If you like, copy the form provided in Figure 5-5 and fill in the defect locations for your drive. Always use a separate form for each drive. When you are ready to initialize your drives, turn to the *CTOS System Administration Guide* for further instructions.

|           |                            |      |          |     |  |           |      |   |          |     |   |   |                     |
|-----------|----------------------------|------|----------|-----|--|-----------|------|---|----------|-----|---|---|---------------------|
| TYPE DISK | G - 20 MB 612 cyls 4 heads |      |          |     |  | SERIAL NO | 2    | 2 | 5        | 3   | 5 | 4 | MEDIA DEFECT REPORT |
|           | CYLINDER                   | HEAD | BFI/SECT |     |  | CYLINDER  | HEAD |   | BFI/SECT |     |   |   |                     |
|           | 0 6 1                      | 0    | # Sect   | 0 1 |  | 0 6 1     | 0    |   | # Sect   | 1 1 |   |   |                     |
|           | 1 1 2                      | 1    | # Sect   | 1 4 |  | 1 1 2     | 1    |   | # Sect   | 1 5 |   |   |                     |
|           | 1 9 6                      | 1    | # Sect   | 1 4 |  | 1 3 3     | 2    |   | # Sect   | 1 4 |   |   |                     |
|           | 0 4 9                      | 3    | # Sect   | 1 3 |  | 0 4 9     | 3    |   | # Sect   | 1 4 |   |   |                     |
|           | 0 4 2                      | 3    | # Sect   | 0 3 |  | 0 4 8     | 3    |   | # Sect   | 1 3 |   |   |                     |

133.5-4

Figure 5-4. Media Defect Label

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**Disk Capacity:** \_\_\_\_\_

**Vendor Code:** \_\_\_\_\_

[illegible]

## Safety Precautions and Equipment Handling

To ensure hazard-free operation, your workstation meets all established safety codes. However, as with any electrical equipment, you should observe certain safety precautions and component handling guidelines. Here is a list of measures you should take.

### Safety Precautions

The following safety precautions are designed to protect you and your co-workers. They also help prevent equipment damage.

- **Never** move processor units or modules while they are turned on.
- Make **sure** that your equipment is turned off whenever you disconnect modules from the string or work with a power supply. Also, make sure that **both** ends of each power supply are disconnected. If you have a B39 or LCW workstation, unplug the processor unit as well.
- Use two people to lift heavy equipment such as B39 processor units, monitors, and certain modules.
- Do not route cables across the floor in commonly traveled areas. You or your co-workers may trip.
- Do not lay equipment on the floor in commonly traveled areas. You or your co-workers may trip on it.

### Equipment Handling

Because it is sensitive to mechanical stress and electrical conditions, computer equipment requires careful handling. Make sure you observe the following guidelines:

- Set your equipment down gently; do not drop it.
- **Never** pick up a module string once it has been connected.
- If you put your processor unit on a shelf, attach the modules while it is on the shelf. Do not attach the modules and then lift the string.

- Before you turn on your workstation, make sure that your hard disk drives are at room temperature. To test for temperature, lay your hand on each hard disk module. If they are cold to the touch, wait until they feel warm and then start your workstation.
- The first time you run any hard disk drive, turn on the workstation and let the disk spin for about 15 minutes before you use it.
- Before you move any hard disk module from one place to another, start the Executive and issue the Head Park command (see the *CTOS Executive Reference Manual*).
- If you are handling X-Bus cards or memory expansions, be careful of static electricity. Here are some guidelines:

- If you unpack a card or expansion before you are ready to install it, do **not** remove it from its static shielding bag.

**Note:** *All X-Bus card and memory expansion bags have a label that warns you about static sensitivity.*

- Hold the card or expansion by its edges and try not to touch any of the components on the card.
- When you handle a card or expansion, minimize your body movement to avoid generating static electricity. Do not hold the card and walk around the room or shuffle your feet. If possible, remain seated while you handle the card.
- Have your tools within easy reach before you take the card out of its bag.

## Where to Go From Here

In this section, you learned how to plan your installation site and make sure that your equipment is comfortably positioned. You should now feel confident with the following tasks:

- You should know how much air space to leave at the front, rear, and top of your workstation in order to prevent overheating.
- You should be able to determine how long your workstation will be once it is installed.
- You should be able to arrange your equipment in a way that is comfortable for you.
- You should be able to perform an inventory of your shipping cartons.

You are now ready to install your workstation. For instructions on installing your equipment, turn to the appropriate *Hardware Installation Guide*. After you have completed your installation, make sure to review Sections 6 and 7 of the *Planning and Owner's Maintenance Guide*. These sections provide information important to the upkeep of your system.



## **Section 6**

# **Maintaining Your Equipment**

**This section tells you about day-to-day equipment maintenance. It also introduces some special procedures that may prove handy as you operate your equipment. The material covered in Section 6 helps ensure a long life for your workstation. If you are working with the equipment for the first time, you should read this section thoroughly before beginning your installation. Section 6 reviews the following subjects:**

- **Owner maintenance**
- **Regular maintenance**
  - **Processor units and modules**
  - **Peripherals**
- **Special procedures**
  - **Rebooting your workstation**
  - **Turning off your workstation**
  - **Moving your equipment**
  - **Power failures**

### Owner Maintenance

As a workstation owner, you are responsible for certain aspects of system maintenance. For your reference, *owner maintenance* is defined as the tasks that you, the user, perform to keep your workstation operating efficiently. These tasks fall into three categories: regular maintenance, special procedures, and troubleshooting. Here is a description of what these tasks involve.

***Regular  
maintenance***

Regular maintenance consists of the steps you regularly take to ensure your workstation's continued reliability and neat appearance. Regular maintenance includes cleaning your equipment, storing your media safely, demagnetizing your color monitor, and so forth.

B2X/B3X workstations are engineered so that you can perform all day-to-day maintenance without the aid of a service representative.

***Special  
procedures***

Special procedures are tasks you perform on an occasional basis; these tasks are not necessarily associated with workstation failures. Special procedures include powering down your workstation to add a module, booting your workstation during software installation, and so forth.

***Troubleshoot-  
ing***

Troubleshooting is the process by which you analyze workstation failures. Most troubleshooting involves looking up status codes generated by your workstation and taking the appropriate action (provided this action does not require dismantling your components). If you read Section 7, you can learn how to troubleshoot and repair various equipment problems. Section 7 also tells you when a service call is necessary.

### Regular Maintenance

You are responsible for performing various regularly scheduled maintenance procedures. Most of these procedures involve cleaning your workstation and making sure that nothing in the environment jeopardizes equipment performance. When operating your workstation, always remember these two precautions:

- **Never** place coffee or other liquids on top of your equipment. Also, keep all top surfaces free of papers and books.
- **Never** impede your workstation's airflow by placing obstructions near the air vents or fans.

### Processor Unit and Modules

Your processor unit and modules are easy to maintain. With one exception, they need little more than regular external cleaning. The exception is the tape module which requires internal cleaning as well. The following paragraphs discuss the procedures you should complete.

### General Maintenance

Always keep your workstation clean. Also, make sure that the area around your equipment is uncluttered. Here are some guidelines:

**Note:** *If you have an LCW processor unit, the guidelines concerning modules, media, and fans do not apply to your workstation.*

- Clean your equipment once a week, as described below.
  - Use a mild household cleaner to clean the outside of your processor unit and modules.
  - Do not drip the cleaner directly onto the equipment. Moisten (do **not** soak) a soft rag and wipe the equipment with the rag.
  - Avoid cleaners that have heavy concentrations of ammonia or chlorine. These chemicals can damage hard disks.
  - Make sure that the cleaner does not come in contact with the internal components of your tape modules, floppy disk modules, or CD-ROM modules.
- Every week, individually check the fans at the rear of your processor unit and modules. To perform this check:
  1. Place your hand near the fan outlet at the rear of the processor unit.
  2. Ensure that air is blowing against your hand and that the airflow is a healthy one.
  3. If the airflow is weak or nonexistent, **immediately** turn off the workstation and contact your service representative.

#### CAUTION

Workstations with inoperative fans are subject to system thermal problems. If you do not shut down your workstation for a fan failure, you may damage the equipment.

4. Repeat steps 1 through 3 for each module in your workstation. Be aware that the strength of the airflow can differ from device to device.

- Every three months, clean all air vents and rear fan vents with a small, soft brush. Perform this step for the processor unit and all modules. Make **sure** you turn off the workstation before you clean the vents and fans. If your environment is a dusty one, you may need to clean your workstation more often.
- Periodically use an air can to remove excess dust from your floppy disk drives and CD-ROM drives. If your drives experience rising error rates, see whether this measure helps. United States customers can order air cans from the *Unisys Supply Catalog* under part number 75-1453-846; international customers should contact their service representatives.
- Keep a schedule of the general maintenance activities you perform. This schedule helps you make sure that these tasks are completed at the appropriate intervals.

### Tape Modules

In addition to cleaning the outside of your tape module, you must also clean one of its internal components. This component is the *tape head*, a device that reads and writes your tape. When a tape passes along a tape head, it leaves a residue. The longer the tape runs, the thicker the layer of residue. If the layer becomes thick enough, the head will have trouble reading the tape. You can prevent residue buildup by periodically cleaning the tape head. As a rule, you should clean the head after every eight hours of continuous tape use. If you are working with a new tape cartridge, the head should be cleaned after the first two hours of tape use.

The following paragraphs describe the tape head cleaning procedures for drives that use digital data storage (DDS) cassettes as well as drives that use quarter-inch cartridges (QIC).

**Note:** *Many DDS drives feature a Media LED; this LED tells you whether a tape is currently inserted. If this LED begins to flash, your drive may be having problems with the media. You can often solve these problems by cleaning the tape heads.*

### DDS Tape Drives

To clean DDS tape heads, you need a tape head cleaning kit. United States customers can order this kit from the *Unisys Supply Catalog* under part number 77-4010-870; international customers should contact their service representatives. Use of other tape head cleaning kits can result in damage to the tape drive, so make sure that you order the right kit.

The kit contains a cassette equipped with cleaning tape. To use the cassette, simply insert it in the tape drive while your workstation is powered-up (see Figure 6-1). The tape drive automatically runs the cleaning tape for about ten seconds. When the drive is finished, it ejects the cassette; **do not** rewind the cassette. You can keep cleaning the drive with the same cassette until the cassette has no more tape.

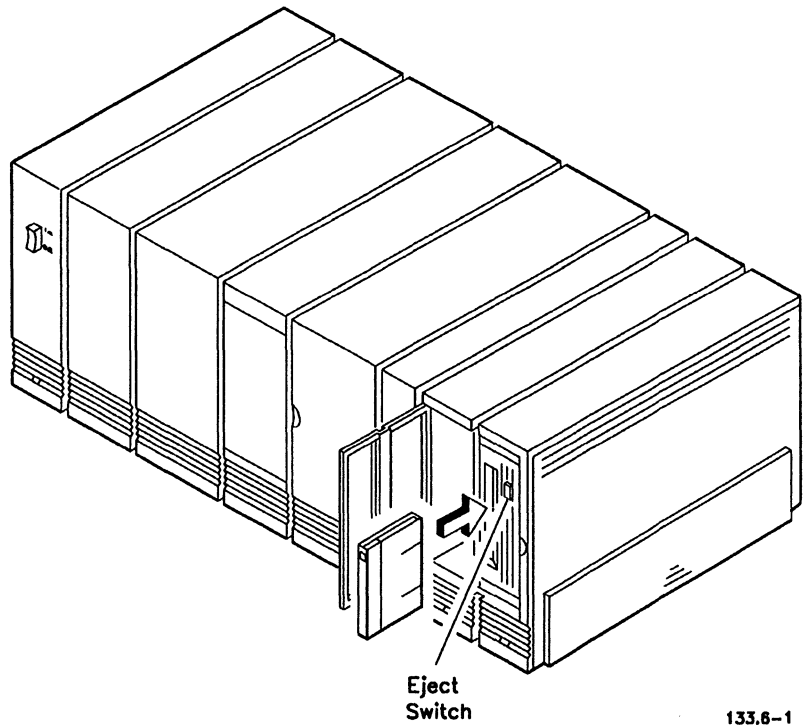


**Figure 6-1. Inserting a DDS Cleaning Cassette**

### QIC Tape Drives

To clean QIC tape heads, you need a tape head cleaning kit. United States customers can order this kit from the *Unisys Supply Catalog* under part number 75-1800-905; international customers should contact their service representatives. Use of other tape head cleaning kits can result in damage to the tape drive, so make sure that you order the right kit. The kit contains six items:

- A cleaning cartridge
- An L-shaped key (stored inside the cleaning cartridge)
- A lever (stored inside the cleaning cartridge; this item is not used)
- Cleaning solution
- Cleaning pads
- Instructions

In case you lose your instructions, you can refer to the following procedure:

1. If the tape module is in use, finish all tape jobs and rewind the tape. Remove the tape cartridge.
2. If the cleaning cartridge does not have a cleaning pad in place, insert one of the spare pads, as shown in Figure 6–2.
3. Moisten the pad with cleaning solution. Do **not** saturate the pad.
4. Lift the lid of the cleaning cartridge storage compartment. Remove the L-shaped key.

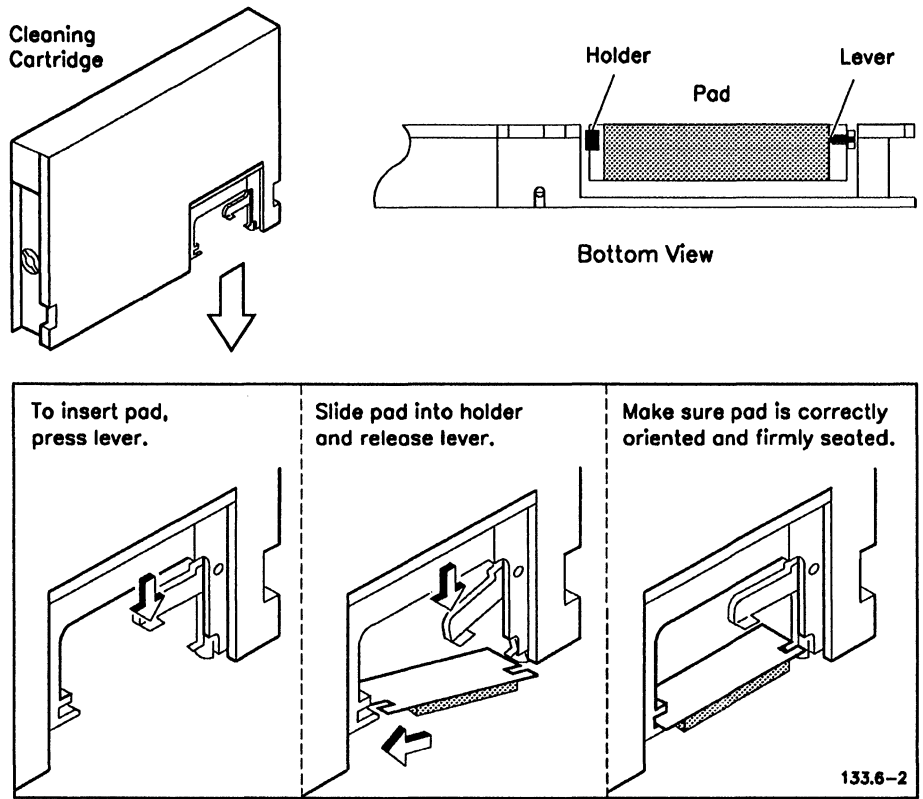


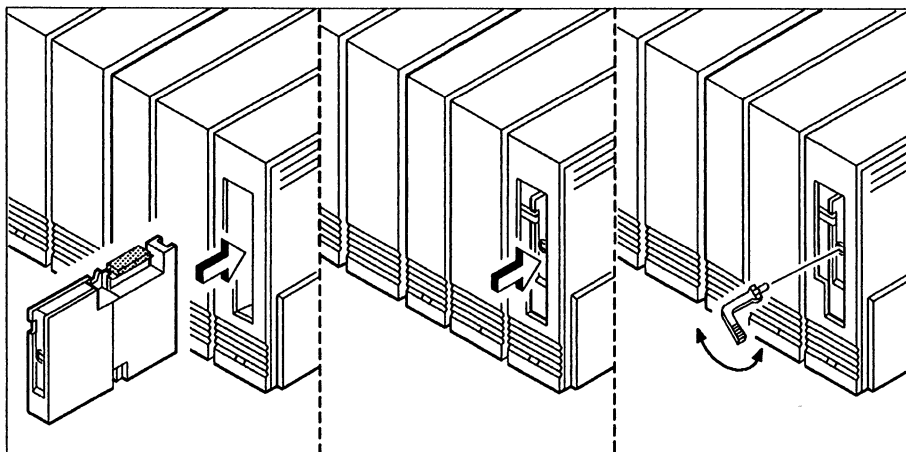
Figure 6-2. Inserting a Cleaning Pad

5. Insert the cleaning cartridge into the tape drive, pad end first (see Figure 6–3).
6. Lock the cartridge in place. This step brings the tape head into contact with the cleaning pad.

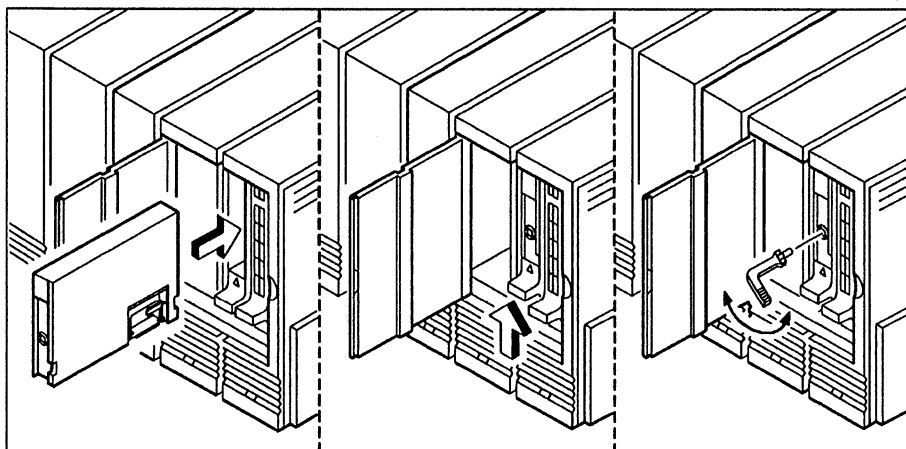
**Note:** *For questions about inserting or locking cartridges, read the “Workstation Startup” section in your Hardware Installation Guide.*

7. Insert the L-shaped key into the notch at the exposed end of the cleaning cartridge.
8. Move the key back and forth 15 to 20 times. This step rubs the cleaning pad against the tape head.
9. Remove the key, release the tape locking mechanism, and take out the cleaning cartridge.
10. Remove and discard the cleaning pad. Insert a fresh cleaning pad.
11. Repeat steps 5 through 9. Do **not** moisten the pad and do **not** remove it when you are finished.
12. Return the L-shaped key to the cleaning cartridge storage compartment.

**TAPE MODULE WITHOUT DOOR**



**TAPE MODULE WITH DOOR**



133.6-3

**Figure 6-3. Inserting a Cleaning Cartridge**

### Peripherals

Your peripherals serve you best if they are kept clean and properly adjusted. The following paragraphs tell you about peripheral upkeep.

#### Monitors

Like other devices in your workstation, your monitor requires regular cleaning. As you become familiar with how your surroundings affect workstation cleanliness, you should develop a cleaning schedule that suits your environment. Here are some guidelines:

- To avoid eyestrain, keep your monitor's brightness adjusted and remove all fingerprints from the screen so that you can see your work clearly.
- If you plan to leave your monitor for any length of time, turn off the screen. To shut down your screen, hold down the **ACTION** key and press the **OVERTYPE** key. When you want to reactivate the screen, press any key on the keyboard.

**Note:** *You can also set up your screen so that it turns off automatically after a specified interval. To enable this feature, start the Executive and issue the Screen Setup command (see the CTOS Executive User's Guide).*

- When cleaning your monitor:
  - Turn off and unplug your monitor. Use a mild household glass cleaner to clean the screen. You can also clean the body of the monitor with this cleaner.
  - Do not drip the cleaner directly onto the monitor. Moisten (do **not** soak) a soft rag and wipe the equipment with the rag.
- At least once every three months, clean the air vents on the monitor with a small, soft brush.
- To correct color uniformity problems:
  - For color monitors with a degauss switch, press the switch.
  - For Unisys color monitors with no degauss switch, turn off the monitor and unplug it from the wall. After 5 minutes, plug the monitor back in and turn it on. This action automatically degausses your screen.

### Keyboards

You can clean your keyboard just as you would clean your monitor. However, when cleaning a keyboard, you should always observe these three guidelines:

- Before you clean your keyboard, disconnect it from the monitor and mouse (or other attachments).
- Be careful not to drip any cleaner between the keys. This can occur if you put too much cleaning solution on your rag.
- If a key sticks, contact your service representative.

### Mice

Most mice contain a component called a tracking ball. The tracking ball is a mechanism that relays your movements to the workstation circuitry for conversion into positional signals.

The tracking ball is located on the underside of your mouse. Because it moves across a surface that is prone to dust and other deposits, you should clean the ball now and again. If you do not keep the tracking ball clean, your mouse may behave erratically.

1. Disconnect the mouse from the keyboard.
2. Turn the mouse over. Observe the dial that holds the tracking ball in place.
3. Turn the dial counterclockwise and lift it away from the mouse, as shown in Figure 6–4.
4. Lift the tracking ball out of the mouse.
5. Moisten a soft cloth with **water only**. Clean the tracking ball with the cloth.
6. Dry the tracking ball thoroughly. Make sure that it is free of lint.
7. Insert the ball into the well. Secure the ball by reinstalling the dial.
8. Reconnect the mouse to the keyboard.

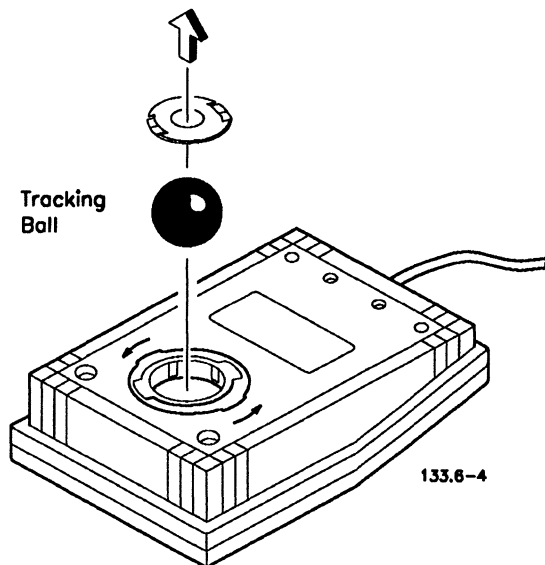


**Figure 6-4. Cleaning a Mouse**

### Other Peripherals

Other peripherals, such as printers and MCRs, should also be kept clean and dust-free. Because the peripheral cleaning procedures vary depending on the model, the *Planning and Owner's Maintenance Guide* does not specifically cover these procedures. To determine the proper cleaning method, read the reference material for the product in question.

# Special Procedures

Once your workstation is installed and running, there are several procedures you will probably perform now and again. The following paragraphs discuss four such procedures.

## Rebooting Your Workstation

All B2X/B3X processor units are equipped with a program called a *bootstrap program*. The bootstrap program locates and loads the correct operating system for your workstation. Bootstrap programs also include diagnostic tests that verify the proper operation of the equipment. The bootstrap program is stored in static ROM and, thus, is a permanent part of the workstation. You can refer to the *CTOS System Administration Guide* for detailed information on bootstrap programs.

Under certain circumstances, you may need to boot your workstation. For those of you unfamiliar with the term, to *boot* or *reboot* your workstation means to force the bootstrap program to execute. When you reboot your workstation, you are, in most cases, restarting the workstation without interrupting system power.

**Note:** *To reboot workstations that have no Reset switch (early versions of the B28-LCW and B28-LC1), you should start the Executive and issue the Bootstrap command. If you cannot use the Executive, you must interrupt system power by turning the processor unit off and on.*

## When to Boot Your Workstation

Situations that involve rebooting your equipment are often software-related. For instance, you sometimes need to reboot your workstation while you install new software. You may also need to reboot your workstation for certain software errors.

## If Your Workstation Is Active

When you reboot your workstation, the bootstrap program interrupts the applications you are currently executing. Because of this, you should always exit your application before you start a boot run. This measure helps prevent data loss during the boot process.

### If You Need to Reboot the Server

If you are rebooting a server, consider the other users in the cluster. These users may be running programs that access the server's disks. Since initiating a boot run can sometimes result in data loss for currently active disk files, **always** inform all cluster users before you boot the server and ask them to release server resources.

### How to Reboot Your Workstation

Before trying to reboot your workstation, make sure you know the location of the Reset switch (see Figure 6–5). To start the boot run, complete the following procedure.

#### CAUTION

In some cases, cluster workstations boot from the server's hard disk rather than their own. After a boot from the server's hard disk, the workstation will be pathed to the server instead of its own hard disk. Its directory will now appear to include many files that were not there before. If you find yourself in this situation, do **not** delete these files or you will destroy server resources. Simply issue the Path command and specify your own directory.

1. Press the Reset switch on the processor unit. If your processor unit does not provide a Reset switch, issue the Executive Bootstrap command or turn the workstation Power switch off and then on.
2. If the boot run generates any status codes, complete the following steps:
  - a. Look up the status code in the *CTOS Status Codes Reference Manual* and take the action indicated. For any status code that requires dismantling a device or removing any internal components, contact your service representative. Do **not** attempt the repair on your own.
  - b. Reboot the workstation. If your workstation issues the status code again, contact your service representative.
3. When the boot run finishes successfully, your screen displays your signon message or other appropriate information.

**More About Boot Runs**

The procedure you just read describes the simplest way to boot your workstation. As you learn more about your equipment, you will find that there are several different methods you can use to boot your system. For details on these methods, see your *CTOS System Administration Guide* and *CTOS Executive Reference Manual*.

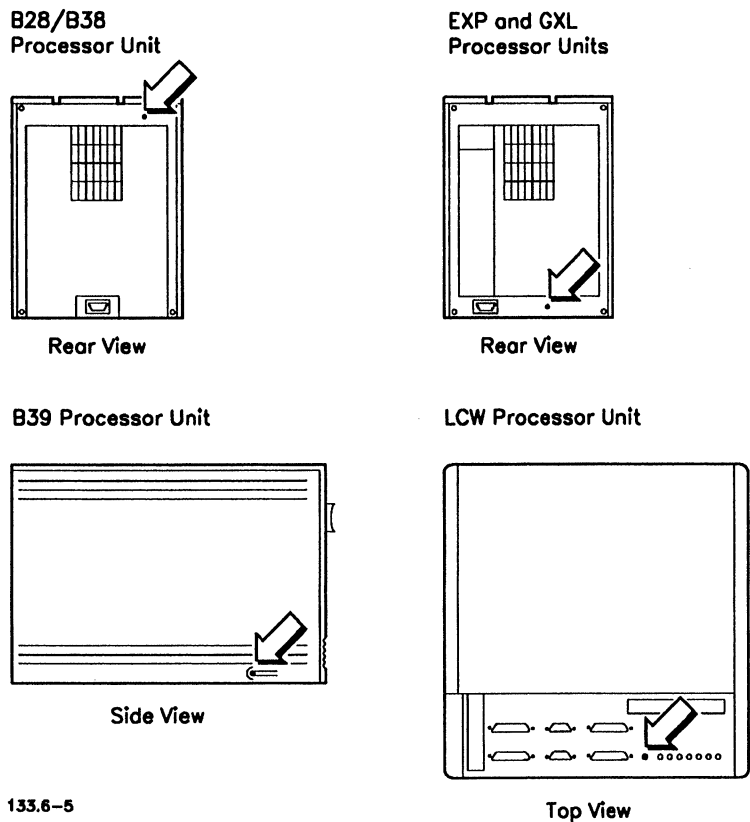


**Figure 6-5. Reset Switch Location**

### Turning Off Your Workstation

Your workstation can remain continuously powered up without harming the equipment. However, to conserve electricity, many users turn their equipment off when it is not in use. You should check your company's policies to determine whether to power down the workstation when you are not using it.

To shut down your workstation, simply turn off the Power switch on your processor unit. Before you power down your equipment, read the following information to find out more about workstation shutdowns, when they are required, and whether they affect other users.

**Note:** *Before turning off the workstation, make sure the Activity LEDs on the drive modules are not lit. If you turn off the system while these LEDs are lit, you may lose data.*

- When you decide to add a module or peripheral to your workstation, you **must** perform the following two steps before you begin:
  1. Shut the workstation off.
  2. Unplug all power supplies from the wall and the rear of the workstation. For B39 and LCW workstations, also unplug the processor unit from the wall.

As an exception, you can disconnect the keyboard and/or any keyboard peripheral without turning off the workstation.

- If you have a cluster workstation, you can generally shut your equipment off without affecting any of the other workstations in the cluster. However, when you turn off a cluster workstation attached to a printer, the other members of the cluster cannot use that printer until the workstation is turned on again.
- Server shutdowns have an impact on every member of the cluster. While the server is off, none of the cluster workstations have access to server files or resources. Thus, before you turn a server off, be sure to inform all cluster users.

### Moving a Workstation or Module

From time to time, you may need to move your workstation or one of your modules. Observe the following rules during the move:

#### CAUTION

Before connecting or disconnecting any module, turn off your workstation. Unplug all power supplies from the wall and the rear of the workstation. For B39 and LCW workstations, also unplug the processor unit from the wall. Failure to observe this precaution will result in equipment damage.

- **Never** move devices that are connected together (for example, modules). First, disconnect them.
- **Never** move equipment to a location that receives direct sunlight.
- **Always** back up your disk files before disconnecting a disk module from the module string.
- **Always** start the Executive and issue the Head Park command before moving any hard disk module. This measure reduces the risk of head and disk damage.
- If you move a floppy disk drive any further than across your desk, insert a blank disk and lock the disk in place. This measure prevents damage to the moving parts of your drive.
- When you reposition your equipment, observe all the guidelines in Section 5.
- Be sure to firmly reconnect any cables you removed.

### Power Failures

From time to time, your building may experience power failures. Power failures, themselves, do not damage your workstation although data loss may occur in files that were active just before the failure. If you are present during a power failure, **immediately** turn off all the devices in your workstation and unplug the power supplies. This measure helps reduce the chances of a power surge when power is restored. Once the power comes back on, remember to turn on your monitor before you turn on the base unit.

**Note:** *Regular backups and save operations lower the risk of data loss if a power failure occurs. You can read about backups and save operations in the CTOS System Administration Guide and the CTOS Executive User's Guide.*

### Where to Go From Here

In this section, you learned how to keep your equipment clean and perform special procedures like booting your workstation. You should now feel confident with the following tasks:

- You should know how often to clean you equipment and check the fans.
- You should be familiar with how to use a tape head cleaning cartridge.
- You should be able to boot your workstation.
- You should know how and when to turn off your equipment.

Now, take a moment to read about troubleshooting so you will be prepared if your workstation develops a problem. For information on troubleshooting, turn to Section 7.

# Section 7

## Troubleshooting

This section discusses some of the problems you can experience as you install and operate your equipment. Section 7 describes several easy steps to take if your workstation has a problem; it also tells you when to contact your service representative. Those of you who are working with the equipment for the first time should read this section thoroughly before beginning your installation. Section 7 reviews the following subjects:

- Introduction to troubleshooting
- Solving workstation failures
  - Common sense and deductive reasoning
  - Preliminary checks
  - Installation problems
  - Diagnostic tools
- Status codes
  - Status code type
  - How status codes are reported
  - What to do about status codes
- LCW startup test results
- Other diagnostic tools

# Introduction to Troubleshooting

*Troubleshooting* is the process by which you analyze equipment failures. When you troubleshoot your workstation, you observe the way your equipment behaves and collect all pertinent data on the failure (error reports and so forth). You then eliminate the possible causes of the problem, one by one.

Most troubleshooting involves looking up status codes that your system generates and taking the appropriate actions. A *status code* is a number that uniquely identifies an error and the circumstances surrounding it. Sometimes, resolving a status code can be as easy as reinserting an incorrectly oriented floppy disk. At other times, the resolution is more complex, often requiring that a device be partially dismantled.

B2X/B3X workstations are designed so that you can troubleshoot and repair certain device faults without the aid of a service representative. As you gain confidence with your workstation, you may have trouble determining whether you should perform a given repair yourself or call a service representative. The more adept you become, the more likely you are to attempt a repair on your own. Before deciding whether to place a service call, read the following discussion:

- **When to perform your own repairs** – If your workstation generates a status code for a problem that can be fixed without dismantling the equipment, perform the repair yourself. For example, some status codes are the result of loose cable connectors. In this case, reseal the connector, boot the workstation, and see whether the status code goes away. Do **not** try to fix problems that require access to the interior of a device or replacement of items like cards, internal power supplies, and so on; you **must** call a service representative when you encounter this type of failure.
- **When to call a service representative** – If your workstation generates a status code that involves replacing a workstation component (a card, an entire module, or the like), call your service representative. The faults that service representatives analyze are usually complex. Service representatives often use sophisticated diagnostic programs to help determine what is wrong. When evaluating a workstation failure, your service representative decides whether the problem can be resolved on site. If it cannot, the service representative takes the component away for repairs or replaces the failing device.

For your reference, the following paragraphs address some of the most common workstation failures and suggest various solutions. The discussion next introduces you to status codes, how they are displayed, and what to do if your workstation generates one. Also included is an explanation of LCW startup testing and status LED interpretation. The discussion closes with a brief overview of special diagnostic packages.

## **Solving Workstation Failures**

If your equipment develops a problem, do not be alarmed. Fixing a workstation can be as straightforward as reseating a loose connector. In solving any problem, your best tools are common sense and a deductive approach.

### **Common Sense and Deductive Reasoning**

Let us say that you turn on your workstation and none of the LEDs light. These symptoms suggest a power fault. Some of the factors that cause power problems are lack of wall power, poor power supply connections, and faulty power components. With this in mind, you might begin troubleshooting by checking your wall source. As a test, you could plug your office lamp into the wall socket you were using for your workstation. If your lamp does not light, you can conclude that you have no wall power.

In this example, you used deductive reasoning to determine that you had a power problem. You used common sense to test the power fault by substituting a device that you were sure of (your lamp) for a device you were not sure of (your workstation).

### Preliminary Checks

Many workstation faults are the result of poor electrical connections. If your workstation develops problems, here are some steps that may help solve them. You should perform these steps before you initiate diagnostic testing.

- Make sure that all power supply connectors are firmly seated. These connectors sometimes loosen if the power supplies are moved. Also, surface vibration can occasionally loosen a connector.
- Observe the LEDs on your processor unit and modules. Give the module string a firm squeeze. If any new LEDs light, there was an incomplete electrical connection somewhere in the string.
- Confirm that all external cables and adapters are firmly connected. Pay special attention to power cables, peripheral cables, TeleCluster adapters, cluster cables, LAN cables, and so forth.

If the problem persists, trace the steps you took to install your workstation. Make sure that you did not omit any of the steps and that you performed each one correctly.

### Installation Problems

The following discussion provides some pointers on solving problems that typically occur during installation. If the actions described below do not help, contact your service representative.

**Nothing happens when I turn on the power.**

- Make sure all power supplies are connected to the wall.
- Make sure all power supply cords are connected to the workstation.
- If you have a B39 or LCW processor unit, make sure it is connected to the wall and that both ends of the connection are firmly seated.
- Check the seating on any other power cables.

**My workstation periodically powers off by itself.**

- Check the seating on all power cables.
- If you have an extra power supply, substitute it for each of the workstation power supplies, one by one. Do not replace all the power supplies at once or you will not know which one is faulty. Should the problem persist, call your service representative.

**The screen is dark when I turn on the power.**

- Check both ends of the monitor cable connection.
- Check the brightness control on the monitor.

**Images on my monitor screen flicker or waver.**

- Check the monitor cable connection.
- Ensure that the monitor cable is not damaged.

**My monitor screen suddenly goes blank.**

- Press any key on the keyboard. If the display reappears, your workstation is set to *time out*, which means the display is set to turn off after a specified period of inactivity. You do not lose any data when the screen turns off. You can turn your screen back on by pressing any key on the keyboard. For more information, see the *CTOS Executive User's Guide*.
- Check the monitor cable connection to make sure that it has not been accidentally pulled free.

**My monitor screen scrolls uncontrollably, the information on the screen is crooked, or the entire screen is not displayed.**

- Call your service representative.

**The entire screen is not displayed.**

- Enter the Executive, issue the Screen Setup command, and respecify the screen length. If your workstation includes a B38-GXL processor unit, a B25-VG3 X-Bus card, or a B25-VG4 module, use a value of 38. For all other workstations, use a value of 29.
- Call your service representative.

**When I type on the keyboard, nothing happens on the screen.**

- Check the keyboard cable connection.
- Check the monitor cable connection.

**When I move my mouse, the cursor on the screen does not move.**

- Clean the mouse and check the mouse cable connection.
- Check the monitor cable connection.
- Reboot your workstation and verify that the proper mouse software has been installed (see the *CTOS System Software Installation Planning Guide*).

**My workstation does not boot when I turn it on.**

- If you are installing operating system software, make sure the correct floppy disk is inserted in the disk drive.
- For workstations connected to a cluster, go to the server and start the Executive. Issue the Cluster Status command to see if the server recognizes your workstation. If it does not, check the cluster cabling. When cabling has been eliminated as the cause, boot the server. Be sure to alert all cluster users **before** you boot the server.

**My workstation cannot communicate with the server.**

- Boot the server. Remember to alert all cluster users first.
- Make sure all the cluster cables are firmly connected.
- For TeleCluster workstations, make sure the TeleCluster adapter is firmly plugged in. If all the cables are connected and you still cannot access the server, check your office for spare TeleCluster adapters. When you find one, substitute it for your adapter and see if the new adapter solves the problem.
- For TeleCluster configurations, have your system administrator restart the hub.

**My workstation cannot communicate with the rest of the LAN network.**

- Boot the server. Remember to alert all cluster users first.
- Make sure all the cluster cables are firmly connected.
- Make sure all the LAN cables are firmly connected.

## Status Codes

Your workstation generates a status code if it encounters an unusual condition. As mentioned, a status code is a number that identifies an error and indicates the state of the system when the error occurred. Status codes are between one and five digits long. By interpreting the status codes that your equipment issues, you can often isolate the source of the error

### **Notes:**

1. *Not all status codes reflect error conditions; some simply indicate that an application is complete.*
2. *While you read about status codes, you may want to glance through your copy of the CTOS Status Codes Reference Manual to familiarize yourself with status code format.*

## Status Code Types

There are two types of status codes: standard error codes (ERCs) and workstation startup codes. Sometimes a standard error code and a startup code have the same number even though their meanings are different. Thus, if your workstation generates a status code, be sure that you know which type of status code it is or you might misinterpret the error. The following paragraphs discuss the two status code types.

### Standard Error Codes

Standard error codes are the most common type of status code. Your workstation can generate an ERC at any time and in any application. ERCs currently have a numerical range of 0-59999 and are almost always expressed in decimal.

ERCs include a special group of codes called crash status codes. Crash status codes indicate a fatal error. If your workstation has a fatal error, it boots automatically and displays the appropriate crash status code.

### Workstation Startup Codes

Startup codes are only generated during workstation power-up, initialization, and booting. These codes are always expressed in hexadecimal. There are two types of startup codes: bootstrap ROM codes and operating system initialization codes.

#### Bootstrap ROM Codes

Bootstrap ROM codes are generated during execution of the bootstrap program. Whenever you turn on or boot your workstation, the bootstrap program executes a series of tests against various hardware elements in your configuration. If any of these tests fails, the workstation generates a two-digit, hexadecimal bootstrap ROM code.

#### Operating System Initialization Codes

As the name implies, operating system initialization codes are generated during operating system initialization. Each time you turn on or boot your workstation, the bootstrap program loads your operating system from your local hard disk drive or from the server. During this process, the software tests various hardware components. If any of the tests fail, the workstation generates an initialization code. This code is up to four hexadecimal digits long. Here is the format of the displayed message:

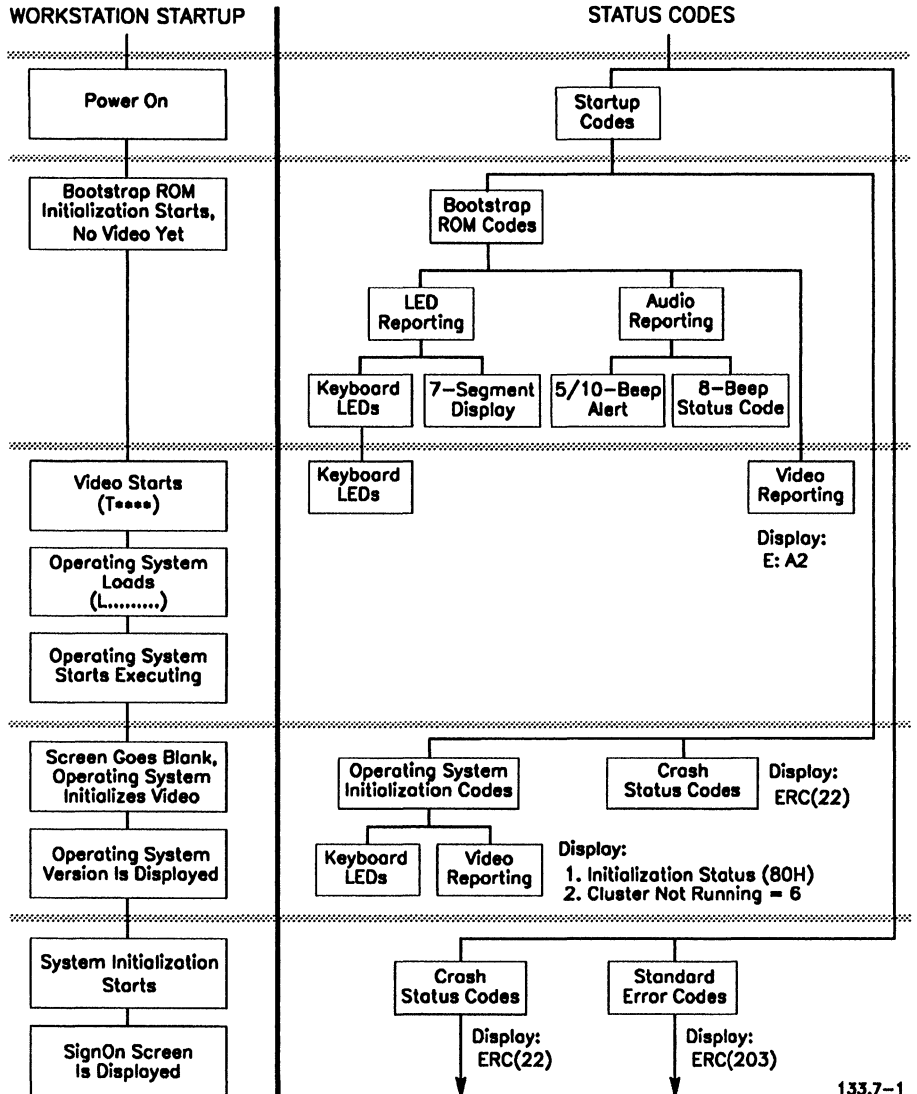
INITIALIZATION ERROR STATUS XXXXH

(where "XXXX" is an initialization code of up to four digits, and "H" indicates that the digits are in hexadecimal)

Unlike other status codes, initialization codes are bit-positional, each bit position representing one of sixteen error conditions. In other words, each digit in the code must be translated into binary to determine which of the sixteen conditions occurred. For further information on the translation method, see the *CTOS Status Codes Reference Manual*.

#### Startup Code Reporting

Operating system initialization codes and bootstrap ROM codes are posted at specific points in the startup process. For your reference, Figure 7-1 provides an overview of status code reporting during startup. The left side of this figure indicates the sequence that your equipment completes when you turn it on. The right side shows the type of status codes posted as each activity is performed. Figure 7-1 also notes how each type of status code is reported (by video, by LEDs, and so on).



133.7-1

Figure 7-1. Workstation Startup and Status Code Reporting

### How Status Codes Are Reported

Your workstation reports status codes in different ways depending on which type of error occurred. For instance, if its circuits have a video problem, your workstation may be unable to use the monitor screen. Instead, it reports the error via the keypad LEDs furnished by most keyboards. For some processor units, it may also report the error on a 7-segment display or on the workstation's speakers. The following discussion indicates the various status code display methods.

#### Monitor Screen

When an error occurs, the associated status code is generally displayed on your monitor screen. For screen displays, the status code is accompanied by an appropriate message. Screen displays are by far the most common display method.

#### Keyboard LEDs

While it is running bootstrap programs and initializing the operating system, your workstation tests its video circuitry. If your workstation experiences a problem at this stage, it may be unable to report the error via the monitor screen. In this case, the error is posted to the keyboard. During the posting process, your workstation lights the LEDs on the **OVERTYPE**, **LOCK**, **F1**, **F2**, **F3**, **F8**, **F9**, and **F10** keys. With **EXP**, **GXL**, and **LCW** processor units, the workstation speaker generally beeps five times (ten times for initialization codes) to alert you.

#### **Notes:**

1. *At the end of a successful boot run or workstation startup, all of the keyboard LEDs light briefly. Do not confuse this display with a status code display in which only some of the LEDs light.*
2. *If you have a B25-K4 keyboard, do not attempt to read the LEDs as status codes; these LEDs serve a different purpose.*
3. *In some instances, **EXP**, **GXL**, and **LCW** workstation speakers may beep eight times. If you hear eight beeps, you should interpret the beeps as a status code (see "Audio Reporting," later in this section).*

To determine the status code, you must convert the lighting pattern of the keyboard LEDs into a two-digit hexadecimal code. The following discussion provides an example of how you decode a keyboard display. As a point of reference, Table 7-1 shows you which LED is associated with which bit position.

**Example:** Your workstation beeps five times and the **OVERTYPE**, **LOCK**, **F1**, and **F10** LEDs light.

1. Using Table 7-1, develop the following chart:

|         | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---------|-------|-------|-------|-------|-------|-------|-------|-------|
| LED     |       |       |       |       |       |       |       |       |
| State:  | On    | On    | On    | Off   | Off   | Off   | Off   | On    |
| Binary: | 1     | 1     | 1     | 0     | 0     | 0     | 0     | 1     |

2. Convert the binary into hexadecimal, four bits at a time (see Table 7-2 for a conversion chart). In this example, bits 4-7 convert to hexadecimal E (1110), and bits 0-3 convert to hexadecimal 1 (0001). The resulting status code is E1.

**Table 7–1. Keyboard LED Bit Conversions**

| Keyboard LED | Bit |
|--------------|-----|
| OVERTYPE     | 7   |
| LOCK         | 6   |
| F1           | 5   |
| F2           | 4   |
| F3           | 3   |
| F8           | 2   |
| F9           | 1   |
| F10          | 0   |

**Table 7–2. Binary-to-Hexadecimal Conversions**

| Binary | Hexadecimal |
|--------|-------------|
| 0000   | 0           |
| 0001   | 1           |
| 0010   | 2           |
| 0011   | 3           |
| 0100   | 4           |
| 0101   | 5           |
| 0110   | 6           |
| 0111   | 7           |
| 1000   | 8           |
| 1001   | 9           |
| 1010   | A           |
| 1011   | B           |
| 1100   | C           |
| 1101   | D           |
| 1110   | E           |
| 1111   | F           |

### Audio Reporting

EXP, GXL, and LCW processor units report certain bootstrap status codes through the workstation speaker only. In this case, your workstation issues all eight bits of the code sonically. The bits are presented in sequential order. Your workstation uses a short tone to express a binary 1 and a long tone to express a binary 0. For instance, if you heard a short-short-short-long-long-long-long-long tone pattern, you would translate it as 11100000, or hexadecimal E0 (see Table 7-2 for help with hexadecimal conversion).

### 7-Segment Display

B39 processor units are equipped with a 7-segment display located at the rear of the cabinet (see Figure 7-2). These units report bootstrap status codes using the 7-segment display as well as by the more common methods. If your workstation issues a status code via the display, it is generally preceded by an audio alarm. Also, the resident SCSI disk drive's LED flashes ten times before the display issues the code.

As mentioned, the bootstrap status codes are each two hexadecimal digits long. Since the display can only show one digit at a time, it generates the high-order digit first. In other words, for the hexadecimal code B3, the display would issue the "B" first and the "3" second.

After the initial display, your processor unit alternates between the two digits of the code. If you are not watching when the system begins issuing the code, you may have trouble determining which digit comes first. Should you experience this problem, simply boot your system, watch the display, and see which digit the processor unit generates first.

Certain digits look like upside down versions of other digits (6 and 9, for instance). Other digits look the same upside down as they do right side up. The digits 0, 1, and 8 are good examples. Because of the 7-segment display orientation, it is easy to misread these digits and misinterpret the status code. As an example, status code 09 can be confused with status code 60 if you look at the display the wrong way. When you read your display, always make sure that you are looking at it right side up (see Figure 7-2).

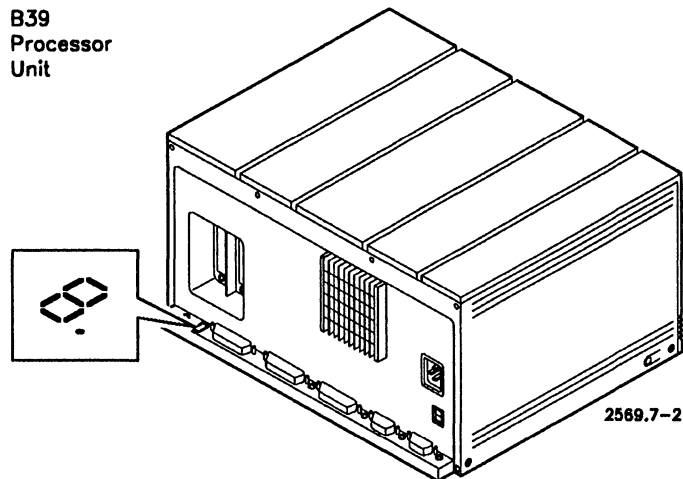


**Figure 7-2. 7-Segment Display Location**

## What To Do About Status Codes

If your workstation issues a status code, look it up in the *CTOS Status Codes Reference Manual*. The situations that cause many of these codes have simple remedies. Some codes are the result of poor connections, others are caused by improperly inserted media, while still others are the product of command entry errors. As you review the definition of your status code, perform any of the suggested actions that do not require access to the interior of the equipment. If these actions do not solve the problem, contact your service representative.

### WARNING

Do not perform procedures that require you to dismantle any device. You may injure yourself or damage the equipment.

# LCW Startup Test Results

In addition to generating status codes, LCW processor units post startup test status via the Status LEDs in the cable bay (see Figure 7–3). This type of reporting occurs each time you turn on your equipment. As you start your LCW processor unit, it executes a series of confidence tests against its components. While it performs these tests, the logic displays a unique Status LED pattern at the beginning of each test. Table 7–3 defines these patterns. If the D1-D5 LEDs do not all turn off at the end of your power-up, refer to the table to determine which test failed and contact your service representative with this information.

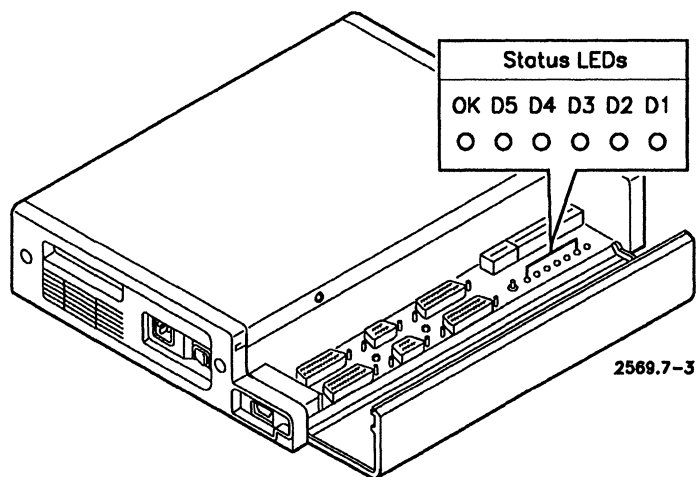


Figure 7–3. LCW Status LED Location

**Table 7-3. Status LED Definitions**

| Status LEDs * |    |    |    |    |    | Definition                                                                                                  |
|---------------|----|----|----|----|----|-------------------------------------------------------------------------------------------------------------|
| OK            | D5 | D4 | D3 | D2 | D1 |                                                                                                             |
| 0             | 1  | 1  | 1  | 1  | 1  | Power on. This pattern is the initial state as the confidence tests begin (green LED off; all red LEDs on). |
| 0             | 0  | 0  | 0  | 0  | 0  | ROM checksum test                                                                                           |
| 0             | 0  | 0  | 0  | 0  | 1  | FW memory test                                                                                              |
| 0             | 0  | 0  | 0  | 1  | 0  | Video and font buffer test                                                                                  |
| 0             | 0  | 0  | 0  | 1  | 1  | Video test                                                                                                  |
| 0             | 0  | 0  | 1  | 0  | 0  | 8254 timer/counter test                                                                                     |
| 0             | 0  | 0  | 1  | 0  | 1  | 8259 interrupt controller test                                                                              |
| 0             | 0  | 0  | 1  | 1  | 0  | 8237 DMA controller test                                                                                    |
| 0             | 0  | 0  | 1  | 1  | 1  | NMI generation logic test                                                                                   |
| 0             | 0  | 1  | 0  | 0  | 0  | 8251 USART test                                                                                             |
| 0             | 0  | 1  | 0  | 0  | 1  | Keyboard test                                                                                               |
| 0             | 0  | 1  | 0  | 1  | 0  | Basic RAM memory test                                                                                       |
| 0             | 0  | 1  | 0  | 1  | 1  | Not used                                                                                                    |
| 0             | 0  | 1  | 1  | 0  | 0  | Not used                                                                                                    |
| 0             | 0  | 1  | 1  | 0  | 1  | Not used                                                                                                    |
| 0             | 0  | 1  | 1  | 1  | 0  | Not used                                                                                                    |
| 1             | 0  | 0  | 0  | 0  | 0  | All tests successfully completed (green LED on; all red LEDs off).                                          |

\* 1 = On; 0 = Off

### Other Diagnostic Tools

At times, you may encounter problems that cannot be solved as just described. In this case, you may need to initiate diagnostic testing using Visinostics. Visinostics is a diagnostic package that analyzes each hardware component in your workstation. Visinostics is available on floppy disk. For further information, refer to the *CTOS Visinostics Operations Guide*.

# Appendix A

## Workstation Specifications

This appendix provides you with some of the specifications you should observe when choosing a location for your equipment. These specifications define the climatic, mechanical, and electrical parameters for your workstation as a whole. If you select a location that does not comply with these specifications, your workstation can experience problems. Appendix A is organized as follows:

- Environmental specifications
  - Operating environment
  - Nonoperating environment
  - Shipping environment
- Electrical specifications

## Environmental Specifications

The following specifications define the environment required for effective workstation operation. These specifications also provide guidelines for maintaining your equipment when it is not operating. If you need to ship a unit to another site, pay close attention to the shipping specifications.

**Note:** *The discussion of shipping specifications assumes that you repack your equipment in its original container using the original shipping material.*

### Operating Environment

|                          |                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Temperature</i>       | +55.4° F to +95° F (+13° C to +35° C)                                                                                                                                                                                                                                                                                                                                            |
| <i>Thermal change</i>    | 18° F per hour (10° C per hour), maximum                                                                                                                                                                                                                                                                                                                                         |
| <i>Relative humidity</i> | 10% to 80% noncondensing                                                                                                                                                                                                                                                                                                                                                         |
| <i>Altitude</i>          | Sea level to 7,000 ft. (2,133.6 m)                                                                                                                                                                                                                                                                                                                                               |
| <i>Maximum vibration</i> | 0.02 in. (0.254 cm) displacement from 5 to 16 Hz; 0.25 G from 16 to 300 Hz with a sweep rate of 0.5 octaves per minute.<br><br><i>Note: For 40- and 80-megabyte SCSI hard disks: 0.1 G acceleration from 5 to 300 Hz with a sweep rate of 0.5 octaves per minute (Read Only). The following devices are subject to this specification: B39-5, B25-MS5, B25-MS6, and B25-XS6.</i> |
| <i>Shock</i>             | 4 G's amplitude with a 10 ms duration, half sine wave.                                                                                                                                                                                                                                                                                                                           |

### Nonoperating Environment

|                          |                                                                                                                        |
|--------------------------|------------------------------------------------------------------------------------------------------------------------|
| <i>Temperature</i>       | -40° F to +149° F (-40° C to +65° C)                                                                                   |
| <i>Thermal change</i>    | 54° F per hour (30° C per hour), maximum                                                                               |
| <i>Relative humidity</i> | 0% to 95% noncondensing                                                                                                |
| <i>Altitude</i>          | Sea level to 14,000 ft. (4267.2 m)                                                                                     |
| <i>Maximum Vibration</i> | 0.1 in. (0.254 cm) displacement from 5 to 12 Hz; 0.75 G from 12 to 300 Hz with a sweep rate of 0.5 octaves per minute. |
| <i>Shock</i>             | 20 G's amplitude with a 10 ms duration, half sine wave.                                                                |

### Shipping Environment

|                          |                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Temperature</i>       | -40 <sup>0</sup> F to +149 <sup>0</sup> F (-40 <sup>0</sup> C to +65 <sup>0</sup> C)                                                                                                                                                                                                                                                                                |
| <i>Thermal change</i>    | 108 <sup>0</sup> F per hour (60 <sup>0</sup> C per hour), maximum                                                                                                                                                                                                                                                                                                   |
| <i>Relative humidity</i> | 0% to 95%                                                                                                                                                                                                                                                                                                                                                           |
| <i>Altitude</i>          | Sea level to 14,000 ft. (4267.2 m)                                                                                                                                                                                                                                                                                                                                  |
| <i>Maximum Vibration</i> | 0.5 G's input with a sweep of 5 to 200 to 5 Hz;<br>0.5 G's dwell for 15 minutes at the four<br>maximum resonant frequencies in three axes.                                                                                                                                                                                                                          |
| <i>Free-fall drop</i>    | Packaged units with a shipping weight of 20 lbs.<br>(9.1 kg) or less can withstand a drop of 36 in.<br>(91.4 cm).<br><br>Packaged units with a shipping weight of 40 lbs.<br>(18.1 kg) or less can withstand a drop of 30 in.<br>(76.2 cm).<br><br>Packaged units with a shipping weight of 60 lbs.<br>(27.2 kg) or less can withstand a drop of 24 in.<br>(61 cm). |

### Electrical Specifications

The overall workstation rating is 115/230 volts, 50/60 Hz. Listed below are electrical specifications reflecting test measurements and ranges.

|                       |                                    |
|-----------------------|------------------------------------|
| <i>115-Volt Range</i> | Tested at 85-135 volts, 47-63 Hz.  |
| <i>230-Volt Range</i> | Tested at 180-270 volts, 47-63 Hz. |



# Glossary

## A

### **application program**

A software program, such as OFIS Graphics or OFIS Document Designer, that performs a specific task or creates an environment in which a task can be completed.

## B

### **boot**

To start a computer by reloading the operating system from a disk or cluster. *See also* reboot.

### **bootstrap program**

A ROM-resident program that contains startup instructions for the system. Bootstrap programs execute each time you power up or reset the workstation. They usually complete a set of tests against various devices in the workstation to ensure proper operation. *See also* reboot.

### **bus**

The circuitry that electronically links the elements of a computer system, transmitting signals from one device to another. *See also* SCSI bus; X-Bus.

## C

### **carrier**

A card that acts as a common connection point for a group of memory expansions.

### **CD-ROM disk drive**

A disk drive that reads a compact disc.

### **central processing unit (CPU)**

The part of a processor unit that controls the interpretation and execution of instructions.

### **cluster**

One or more workstations connected to a server. *See also* cluster workstation; server.

### **cluster workstation**

A workstation that is connected to a server; the cluster workstation uses the server to store some or all of its files and to execute application programs.

### **compact disc (CD)**

An optically encoded disc; compact discs are used with CD-ROM disk drives. *See also* disk.

### **configuration**

The combination of hardware and software elements that constitute a computer system.

### **connector**

A physical device, such as a plug, socket, or jack, used to connect hardware components or cables in a computer system.

### **core device**

A hardware component that is part of every workstation, regardless of the workstation's size. B2X/B3X workstations require three core devices: a processor unit, a monitor, and a keyboard.

### **CTOS operating system**

A realtime, message-based, multitasking operating system.

## **D**

### **daisy chain**

A cluster connection that links computer systems together so that the signals pass from the first system to the second, from the second to the third, and so on.

**disk**

An information storage medium consisting of a flat, round surface used to store data. The data may be magnetically or optically encoded depending on the type of disk.

**disk drive**

A device that writes and reads information on the surface of a magnetic disk.

**E**

**Ethernet**

The technological base for one type of local area network. *See also* local area network.

**F**

**floppy disk**

A magnetically encoded disk that is flexible; floppy disks can be removed from the disk drive. *See also* disk.

**floppy disk drive**

A disk drive that writes and reads floppy disks. *See also* disk drive.

**H**

**hard disk**

A magnetically encoded disk that is rigid and cannot be removed from the disk drive. *See also* disk.

**hard disk drive**

A disk drive that writes and reads hard disks. *See also* disk drive.

**hardware**

The physical components of a computer system. *See also* software.

### K

#### **keyboard**

A device that enables users to input data directly into the computer system.

### L

#### **local area network (LAN)**

A group of clusters tied together so that members of the various clusters can share the resources of other clusters in the network.

#### **local file system**

A hard disk module (usually includes a floppy disk drive) that is directly attached to a workstation. A workstation with a local file system can run programs and access files without having to be attached to a server.

### M

#### **memory**

A hardware or software component of a computer system that stores information for retrieval.

#### **memory cartridge**

A memory expansion enclosed in a protective plastic case.

#### **memory expansion**

Circuitry that provides additional memory for the system; memory expansions are installed in the processor unit.

#### **modem**

A device that converts digital computer signals so that they can be transmitted using telephone lines.

#### **module**

A device that enhances a workstation by adding such capabilities as graphics processing, disk storage, tape backup facilities, networking, and so forth. Modules are attached to the right side of a processor unit or to another module.

**monitor**

A device equipped with a screen that acts as a visual interface to the computer system. Monitors allow you to supervise, control, and verify the operation of a system or the performance of a task.

**mouse**

A pointing device that allows you to position the cursor on the monitor screen.

**N**

**network**

One or more servers connected together to form a network of clusters.

**O**

**operating system**

Software that controls the general function of a workstation. Operating systems may also provide resources, such as data management, for the workstation. *See also* CTOS operating system.

**P**

**parallel printer**

A printer that receives and transmits data bits in parallel bursts of one or more bytes as opposed to serially (bit by bit). *See also* printer; serial printer.

**parallel printer cable**

A cable used to attach a parallel printer to the computer system.

**peripheral**

A device (such as a printer, monitor, or modem) that attaches to one of the external ports on the workstation.

**port**

*See* connector.

### **power code**

A number that reflects the power consumption of a module or peripheral. These numbers are added to determine how many power supplies the workstation needs.

### **power supply**

A device that connects modules in a computer system to an ac receptacle. Power supplies convert the line voltage from the wall socket into the voltage needed by the workstation.

### **printer**

A device that generates a printed copy of computer files, screen information, and so forth.

### **processor unit**

The hardware component responsible for the basic control functions performed by the workstation. The processor unit contains the CPU, memory, and associated circuitry. *See also* central processor unit.

## **R**

### **Random Access Memory (RAM)**

A type of memory that allows both read and write operations. This type of memory is used to run applications programs and other types of nonpermanent software.

### **Read Only Memory (ROM)**

A type of memory that allows only read operations. This type of memory stores programs that remain a permanent part of the system (for example, bootstrap routines).

### **reboot**

To restart a workstation. *See also* boot.

### **reset**

*See* reboot.

**RS-232-C cable**

An industry-standard cable commonly used to connect printers and modems to your computer system.

**RS-422/485 cable**

An industry-standard cable commonly used to connect workstations in a cluster.

**S**

**SCSI (Small Computer System Interface) bus**

A bus used for communication between modules and intelligent peripherals.

**SCSI module**

An individually housed module that expands system capabilities. SCSI modules utilize the SCSI bus to communicate with other SCSI modules in the workstation; to communicate with the processor unit, SCSI modules must be connected to the X-Bus through a SCSI controller (upgrade module). *See also* module.

**serial device**

A device that sends or receives data bits one at a time. *See also* modem; serial printer.

**serial printer**

A printer that receives data bits one at a time. *See also* parallel printer; printer.

**server**

A workstation or shared resource processor™ designated as the controlling unit of a cluster. The server runs application programs and system services used by workstations in the cluster, supervises cluster access to attached peripherals, and provides individual resources (such as disk space) to each workstation in the cluster.

**Single Inline Memory Module (SIMM)**

A memory expansion whose RAM circuitry is mounted on a compact card.

### **software**

Programs and procedures that control the operation of a computer system. *See also* hardware.

### **standalone workstation**

A workstation, not attached to a cluster, that contains a local file system.

### **status code**

A code that notifies a user of workstation status. Status codes are the main error reporting mechanism for the workstation.

### **system administrator**

The person responsible for maintaining a computer system.

### **system services**

Software programs (such as GPS) that are supported by the operating system and, in turn, support application programs.

## **T**

### **tape cartridge**

A cartridge that contains a reel of magnetic tape used to store data.

### **tape module**

A device that writes and reads information on the surface of a magnetic tape.

### **TeleCluster**

A clustering product that utilizes twisted-pair cables to connect cluster workstations through a TeleCluster hub.

### **token ring**

The technological base for one type of local area network. *See also* local area network.

## V

### **video display unit**

*See* monitor.

## W

### **wide area network (WAN)**

A group of clusters tied together so that members of the various clusters can share the resources of other clusters in the network. WANs can transmit data over longer distances than LANs.

## X

### **X-Bus**

A system bus that connects various modules in the workstation.

### **X-Bus card**

A card that enhances the processor unit by adding such capabilities as graphics processing. X-Bus cards are a space-saving alternative to modules that provide like functions.

### **X-Bus module**

An individually housed module that expands system capabilities and utilizes the X-Bus to communicate with the processor unit and other modules. *See also* module.



# Index

1PC PC Emulator modules  
  cluster access, 4-4  
  general discussion, 1-26, 2-4, 3-11,  
    3-13  
7-segment display, 7-14

## A

ac line cables  
  for B39 processor units, 2-19  
  for LCW processor units, 2-19  
  for monitors and peripherals, 2-19  
  for PS power supplies, 2-19  
  for PS1 power supplies, 2-19  
ac outlets, 3-26  
ac voltage, 3-19  
addressing, 3-16  
AG2 graphics modules, 2-4 to 2-5

## B

B27 modules, 2-9, 3-13  
B28/B38 processor units  
  as a server, 4-6  
  B28-CPU, 2-14 to 2-15  
  B28-EV, 2-15  
  B28-MCP, 2-14  
  B28-MEV, 2-15  
  B38-CPU, 2-14 to 2-15  
  B38-EV, 2-5, 2-14 to 2-15  
  B38-MCP, 2-14 to 2-15  
  B38-MEV, 2-14 to 2-15  
  configuring modules with, 3-3 to  
    3-4

  enhanced video capabilities, 1-11  
  general discussion, 1-8  
  IBM PC emulation, 1-10  
  in a cluster, 4-6  
  math coprocessor, 1-10  
  memory expansions, 1-11, 1-24,  
    2-3  
  Reset switch, 6-17  
B28/B38 workstations  
  hardware components, 1-11  
  memory expansions, 2-3  
  module compatibility, 2-4  
  monitor compatibility, 2-4  
  processor units, xvii, 1-10  
  X-Bus cards, 2-4  
B28-1MB memory expansions, 2-3  
B28-2MB memory expansions, 2-6  
  to 2-7  
B39-4MB memory expansions, 2-4  
B39-EV1 X-Bus cards, 2-5  
B39 processor units  
  7-segment display, 7-14  
  as a server, 4-6  
  configuring modules with, 3-6, 3-8  
  general discussion, 1-8, 1-13, 2-14  
    to 2-15  
  IBM PC emulation, 1-13  
  in a cluster, 4-6  
  memory expansions, 1-13, 1-24,  
    2-4  
  Reset switch, 6-17  
  SIMMs, 1-13  
  X-Bus cards, 1-25, 2-4 to 2-5

### B39 workstations

- enhanced video capabilities, 1-14
- hard disks, 1-14
- hardware components, 1-14
- memory expansions, 1-13, 2-4
- module compatibility, 2-5
- monitor compatibility, 2-5
- processor units, xvii, 1-13
- X-Bus cards, 1-13

bootstrap programs (*See* rebooting workstations)

buses, 1-3

## C

CA1 monitors, 1-28, 2-4 to 2-5

cable compatibility, 2-18 to 2-20

### cables

#### ac line cables

- B39 processor units, 2-19
- LCW processor units, 2-19
- monitors and peripherals, 2-19
- PS power supplies, 2-19
- PS1 power supplies, 2-19

#### cluster cable

- RS-422/485, 2-20
- TeleCluster, 2-20

#### dc power supply cable, 2-19

general discussion, 2-1, 2-18

keyboard cable, 2-19

#### LAN cable

- Ethernet, 2-20
- token ring, 2-20

#### printer cable

- parallel, 2-20
- serial, 2-20

### video cable

- GXL processor unit, 2-19
- VGA monitor, 2-19
- video adapter, 2-19
- VKA adapter, 2-19

CD3 monitors, 1-28

CDC CD-ROM modules, 1-26, 2-4, 2-11, 3-11, 6-4

CDX CD-ROM modules, 1-26, 2-4, 2-11 to 2-12, 3-28, 6-4

central processing unit, 1-4

cluster workstations (*See* clusters)

### clusters

#### cables

- RS-422/485, 2-20
- TeleCluster, 2-20

#### connection schemes

- combined clusters, 4-8
- RS-422/485, 4-7 to 4-8
- TeleCluster, 4-7 to 4-8

general discussion, 1-3, 4-2 to 4-8

number of workstations in, 4-6

planning, 4-3 to 4-4

turning off workstations, 6-18

#### types of cluster workstations

- B28/B38 processor units, 4-6
- B39 processor units, 4-6
- EV processor units, 4-6
- EXP processor units, 4-6
- GXL processor units, 4-6
- LCW processor units, 4-6
- MEV processor units, 4-6

#### types of servers

- B28/B38 processor units, 4-6
- B39 processor units, 4-6
- EXP processor units, 4-6
- GXL processor units, 4-6

- comfortable workspace, 5-8 to 5-9
- communications modules, 1-26
- compact discs
  - general discussion, 1-26, 3-28
  - maintenance, 6-4
- compact workstation
  - configuration of, 3-29
  - general discussion, 3-28
- compatibility
  - cables
    - ac line cable, 2-19
    - cluster cable, 2-20
    - dc power supply cable, 2-19
    - general discussion, 2-1, 2-18
    - keyboard cable, 2-19
    - LAN cable, 2-20
    - printer cable, 2-20
    - video cable, 2-19
  - hardware, 2-3
  - modules, 2-1 to 2-4
  - peripherals, 2-1
  - processor units
    - general discussion, 2-1, 2-3
    - graphics controllers, 2-13 to 2-17
  - software
    - applications, 2-2
    - operating system, 2-2
- configuring modules, 3-2
  - B28/B38 processor units
    - SCSI modules, 3-4
    - X-Bus and SCSI modules, 3-4
    - X-Bus modules, 3-3
  - B39 processor units
    - SCSI modules, 3-6
    - X-Bus and SCSI modules, 3-8
    - X-Bus modules, 3-6
- EXP processor units
  - SCSI modules, 3-4
  - X-Bus and SCSI modules, 3-4
  - X-Bus modules, 3-3
- GXL processor units
  - SCSI modules, 3-4
  - X-Bus and SCSI modules, 3-4
  - X-Bus modules, 3-3
- SCSI modules
  - B28/B38 processor units, 3-4
  - B39 processor units, 3-6
  - EXP processor units, 3-4
  - general discussion, 3-3
  - GXL processor units, 3-4
- X-Bus and SCSI module combinations
  - B28/B38 processor units, 3-4
  - B39 processor units, 3-8
  - EXP processor units, 3-4
  - general discussion, 3-4
  - GXL processor units, 3-4
- X-Bus modules
  - B28/B38 processor units, 3-3
  - B39 processor units, 3-6
  - EXP processor units, 3-3
  - general discussion, 3-3
  - GXL processor units, 3-3
- conventions, xvii to xviii
- core devices, 1-2, 1-6
- CPU (*See* central processing unit)
- CX5 disk module, 2-11 to 2-12
- CX6 disk module, 2-11 to 2-12

### D

- D1 monitors, 1-28
- D2 monitors, 1-28
- D3 monitors, 1-28
- D5/D6 monitors, 1-28
- data communications devices, 3-11
- dc voltage, 3-19
- DCX communication modules
  - cluster access, 4-4
  - general discussion, 3-11, 3-13, 3-18
- DDS tape modules
  - general discussion, 2-11 to 2-12
  - maintenance, 6-6 to 6-7
- degauss switch, 6-12
- design concepts
  - modularity, 1-2 to 1-3
  - networking, 1-3
- diagnostic tools, 7-18
- disk modules
  - general discussion, 1-26
  - power codes, 3-22
- disk upgrades and expansions, 2-10 to 2-12
- DN1 X-Bus cards, 2-5 to 2-7, 4-14
- DN2 network modules, 3-11, 4-14

### E

- electrical specifications, A-3
- EN3 LAN modules
  - cluster access, 4-4
  - general discussion, 3-11, 3-13
- environmental specifications
  - general discussion, A-1 to A-3
  - nonoperating, A-2
  - operating, A-2

- shipping, A-3
- equipment handling
  - disks, 5-16
  - memory expansions, 5-16
  - processor units, 5-15
  - X-Bus cards, 5-16
- equipment location
  - distance factors
    - general discussion, 5-7
    - keyboard to monitor, 5-7
    - monitor to graphics module, 5-7
    - monitor to processor, 5-7
    - power supply to processor, 5-7
    - power supply to wall, 5-7
  - general discussion, 5-3
  - physical placement, 5-3 to 5-4
  - space requirements
    - general discussion, 5-4
    - keyboards, 5-5
    - module dimensions, 5-7
    - monitors, 5-5
    - mouse, 5-5
    - PIN keypad, 5-5
    - worksheet, 5-6
- ERCs (*See* standard error codes)
- Ethernet LAN modules (*See* EN3 LAN modules)
- Ethernet
  - EN3 LAN modules, 3-11 to 3-13, 3-28, 4-12
  - link, 4-12
  - node, 4-12
  - package, 4-12
  - repeater, 4-12
  - segment, 4-12
  - terminator, 4-12
  - X100-MAU, 4-12

**EXP processor units**

- as a server, 4-6
  - B28-EX1, 2-13 to 2-14
  - B28-EXP, 2-13 to 2-14
  - B38-EXP, 2-13 to 2-14
  - B38-GXP, 2-13 to 2-14
  - base memory, 1-17, 2-6
  - configuring modules for, 3-3 to 3-4
  - enhanced video capabilities, 1-16
  - general discussion, 1-8, 1-16
  - IBM PC emulation, 1-16
  - in a cluster, 4-6
  - main memory, 1-8
  - memory expansion, 1-17, 1-24, 2-4, 2-6
  - Reset switch, 6-17
  - status code reporting methods, 7-10, 7-14
  - X-Bus cards, 1-16, 1-25, 2-6
- EXP workstations**
- base memory, 2-6
  - graphics modules
    - VG2, 2-6
    - VG4, 2-6
  - hardware components, 1-17
  - memory expansion compatibility, 2-4, 2-6
  - module compatibility, 2-7
  - monitor compatibility, 2-6
  - processor units, xvii, 1-16
  - used with X-Bus disk upgrades, 2-6
  - X-Bus card compatibility, 2-6

**F****floppy disk drives**

- addressing, 3-16
- maintenance, 6-4
- moving, 6-19

**FXC adapter modules, 2-9, 3-13**

**G**

**GPP graphics modules, 2-4 to 2-5, 2-17**

**GRA graphics modules, 2-2, 2-5, 2-17**

**graphics modules, 1-26**

**AG2, 2-4, 2-5**

**GPP, 2-4 to 2-5, 2-17**

**GRA, 2-2, 2-5, 2-17**

**GRE, 2-5, 2-17**

**power codes, 3-22**

**VG2, 2-6**

**VG4, 2-6**

**graphics workstation**

**configuration of, 3-29**

**general discussion, 3-28**

**GRE graphics modules, 2-5, 2-17**

**GS1 monitors, 1-29, 2-4 to 2-5**

**GXL processor units**

**as a server, 4-6**

**B38-GXL, 2-13 to 2-14**

**base memory, 1-19, 2-7**

**cache circuitry, 1-19**

**configuring modules for, 3-3 to 3-4**

- enhanced video capabilities, 1-19
- general discussion, 1-8, 1-19 to 1-20
- graphics controllers, 2-16
- IBM PC emulation, 1-19
- in a cluster, 4-6
- internal graphics control circuitry, 1-19
- keyboard configuration, 3-18
- main memory, 1-8
- memory expansion, 1-19, 1-24, 2-7
- Reset switch, 6-17
- status code reporting methods, 7-10, 7-14
- X-Bus cards, 1-19, 1-25, 2-7
- GXL workstations
  - base memory, 1-19
  - graphics modules, 2-8
  - hardware components, 1-20
  - memory expansion compatibility, 2-7
  - module compatibility, 2-7
  - processor units, xvii, 1-19
  - X-Bus card compatibility, 2-7

## H

- hard disks in B39 processor units, 1-14
- hardware compatibility
  - and application software, 2-2
  - and operating systems, 2-2
  - cables, 2-18 to 2-21
  - monitors, 2-13 to 2-17
  - with B28/B38 processor units, 2-3 to 2-4
  - with B39 processor units, 2-4 to 2-5

- with buses and modules, 2-9 to 2-12
- with EXP processor units, 2-6 to 2-7
- with GXL processor units, 2-7 to 2-8
- with LCW processor units, 2-8
- hardware components
  - B28/B38 workstations, 1-11
  - B39 workstations, 1-14
  - EXP workstations, 1-17
  - GXL workstations, 1-20
  - keyboards, 1-30
  - LCW workstations, 1-23
  - memory expansions, 1-4
  - monitors, 1-28
  - modules, 1-4, 1-26
  - peripherals, 1-6
  - power supplies, 1-6
  - processor units, 1-4
  - special attachments
    - MCRs, 1-30
    - mice, 1-30
    - PIN keypads, 1-30
  - X-Bus cards, 1-6
- high-performance workstation
  - configuration of, 3-29
  - general discussion, 3-28

## I

- ID2 communication modules
  - cluster access, 4-4
  - general discussion, 3-11, 3-13
- IDS communication modules
  - cluster access, 4-4
  - general discussion, 3-11, 3-13

installation site, 5-2  
ISDN module (*See* DN2 network modules)  
inventory worksheet, 5-11 to 5-12

## K

K1 keyboards, 1-30  
K2 keyboards, 1-30  
K3 keyboards, 1-30  
K4 keyboards, 1-30  
K5 keyboards, 1-30  
keyboard LEDs  
    K4, 7-10  
    status code bit conversion, 7-11  
keyboards  
    distance factors, 5-7  
    general discussion, 1-30, 5-5  
    K1, 1-30  
    K2, 1-30  
    K3, 1-30  
    K4, 1-30  
    K5, 1-30  
    maintenance, 6-13  
    SG-101-K, 1-30  
    space requirements, 5-4

## L

LAN cable  
    Ethernet, 2-20  
    Token ring, 2-20  
LAN modules  
    EN3, 3-11 to 3-12  
    general discussion, 1-26  
    TR2, 3-11, 3-12  
LANs  
    cluster access, 4-4

combined networks  
    connected to WANs, 4-14  
    using DCX modules, 4-14  
    using DN1 X-Bus cards, 4-14  
    using DN2 modules, 4-14  
    using ID2 modules, 4-14  
    using IDS modules, 4-14

### Ethernet

    data packages, 4-12  
    EN3 LAN modules, 4-12  
    link, 4-12  
    node, 4-12  
    repeater, 4-12  
    segment, 4-12  
    terminator, 4-12  
    X100-MAU, 4-12  
general discussion, 1-3, 4-10 to 4-15  
token ring  
    data packages, 4-14  
    TR2 LAN modules, 4-14  
topology  
    bus, 4-12  
    ring, 4-14  
troubleshooting, 7-6  
LCW processor units  
    B28-LC1, 2-13 to 2-14  
    B28-LCW, 2-13 to 2-14  
    base memory, 1-22, 2-8  
    enhanced video capabilities, 1-22  
    general discussion, xvii, 1-9, 1-22, 3-28  
    in a cluster, 4-6  
    memory expansion, 1-22, 1-24  
    Reset switch, 6-17  
    startup test results, 7-16  
    status code reporting methods, 7-10, 7-14  
    status LEDs, 7-16

### LCW workstations

- base memory, 1-22, 2-8
  - hardware components, 1-23
  - memory expansions, 1-19
  - processor units, xvii, 1-19
  - rebooting, 6-15
  - status code reporting methods,  
7-10, 7-14
  - status LEDs, 7-16
- lightning, 3-27
- local area networks (*See* LANs)

## M

- M0 disk modules, 3-13, 3-16
- M3 disk modules, 2-11
- M4 disk modules, 2-11
- M5 disk modules, 2-11
- magnetic card readers (*See* MCRs)
- maintenance
- general discussion, 6-1 to 6-20
  - regular maintenance
  - compact discs, 6-4 to 6-5
  - floppy disks, 6-4
  - general discussion, 6-2
  - keyboards, 6-13
  - mice, 6-13
  - monitors, 6-12
  - peripherals, 6-14
  - processor units, 6-3 to 6-5
  - tape modules, 6-5 to 6-11
- special procedures
- general discussion, 6-2
  - moving a module, 6-19
  - moving a workstation, 6-19
  - power failures, 6-20
  - rebooting a workstation, 6-15 to  
6-17
  - turning off a workstation, 6-18
  - troubleshooting, 6-2

- master (*See* server)
- MC5 disk modules, 2-11
- MC6 disk modules, 2-11
- MCRs, 1-30
- media defects, 5-13 to 5-14
- memory expansions
- B28/B38 processor units, 1-11, 2-3  
to 2-4
  - B39 processor units, 1-13, 2-4
  - core devices, 1-2
  - EXP processor units, 2-6 to 2-7
  - GXL processor units, 1-19, 2-7 to  
2-8
- handling, 5-16
- LCW processor units, 2-8
- power codes, 3-22
- types of
- carrier/memory card  
combinations, 1-24
  - cartridges, 1-24
  - general discussion, 1-10, 1-24
  - memory cards, 1-24
  - SIMMs, 1-24
- mice
- cleaning, 6-13
  - distance factors, 5-7
  - general discussion, 1-30 to 1-32,  
5-5
  - space requirements, 5-4
- module compatibility
- B27 modules, 2-9
  - disk upgrades and expansions,  
2-10 to 2-12
  - FXC adapter modules, 2-9
  - SCSI bus, 2-9
  - X-Bus, 2-9
- module string, 1-3

**modules**

- checking fans, 6-4
- configuring, 3-2 to 3-13
- controllers, 1-4
- dimensions, 5-7
- disk modules, 1-26
- enhancing a workstation, 1-2
- moving, 6-19
- placement of, 3-12 to 3-13
- types of, 1-26

**monitors**

- degauss switch, 6-12
- display modes, 2-14
- distance factors, 5-7
- general discussion, 1-28 to 1-30, 5-5
- graphics controllers with, 2-16
- maintenance, 6-12
- power codes, 3-22
- space requirements, 5-4
- timeout feature, 6-12
- types of, 1-28 to 1-30

**moving workstations, 6-19****MS5 disk modules, 2-11, 3-13****MS6 disk modules, 2-11, 3-13****MS7 disk modules, 2-11, 3-13****MS8 disk modules, 2-11, 3-13****MS9 disk modules, 2-11, 3-13****MSA disk modules, 2-11, 3-13****MU5 disk modules, 2-11 to 2-12****MX3 disk modules, 2-11 to 2-12****MX4 disk modules, 2-11 to 2-12****MX5 disk modules, 2-11 to 2-12****MX6 disk modules, 2-11 to 2-12****N****networks**

- combined networks, 4-14
- general discussion, 1-3, 4-10 to 4-15

**LANs**

- general discussion, 4-11 to 4-12
- Ethernet LANs, 4-12
- token ring LANs, 4-14
- nonoperating environment, A-2

**O**

- operating environment, A-2
- organization of guide, xv to xvi

**P****PD7 monitors, 1-29, 2-4 to 2-5****PD8 monitors, 1-30, 2-4 to 2-5****PEM peripheral extension modules**

- cluster access, 4-4
- general discussion, 3-11, 3-13, 3-18

**peripheral compatibility**

- data communications modules, 2-18
- general discussion, 2-13 to 2-18
- graphics controllers, 2-16
- keyboards, 2-18
- monitor adapters, 2-17
- monitors, 2-13 to 2-18
- printers, 2-18
- with processor units, 2-13 to 2-18

**peripherals**

- compatibility, 2-13 to 2-18
- data communication modules, 3-18

**financial equipment, 3-18****FSA port, 3-18****general discussion, 1-6****keyboard, 3-18 to 3-19****maintenance of, 6-12 to 6-14****MCR, 3-18****mice, 3-18**

- monitor compatibility, 2-13 to 2-17
  - monitors, 3-18
  - number of, 3-18
  - PIN keypads, 3-18
  - placement of, 3-18
  - printers, 3-18
  - used with DCX modules, 3-13, 3-19
  - used with PEM modules, 3-18
  - wide area networks, 3-19
  - personal identification numbers  
(See PIN keypad)
  - PIN keypad
    - general discussion, 1-30, 5-5
    - space requirements, 5-4
  - power codes
    - communications modules, 3-22
    - disk modules, 3-22
    - general discussion, 3-20 to 3-21
    - graphics modules, 3-22
    - memory expansions, 3-22
    - monitors, 3-22
    - processor units, 3-22
    - special-purpose modules, 3-22
    - tape modules, 3-22
    - worksheet for, 3-23
  - power configuration, 3-19 to 3-27
  - power failures, 6-20
  - power supplies
    - function of, 3-19
    - general discussion, 1-6
    - number of, 3-20
    - placement of
      - general discussion, 3-19
      - in B28/B38 workstations, 3-24
      - in B39 workstations, 3-26
      - in EXP workstations, 3-24
      - in GXL workstations, 3-24
      - in LCW workstations, 3-26
  - printer cable
    - parallel, 2-20
    - serial, 2-20
  - processor units
    - B28/B38 processor units, 1-8, 1-10 to 1-11
    - B39 processor units, 1-8, 1-13 to 1-14
    - enhancements, 1-24
    - memory expansions, 1-24
    - X-Bus cards, 1-25
    - EXP processor units, 1-8, 1-16 to 1-17
    - graphics controller compatibility, 2-14 to 2-15
    - GXL processor units, 1-8, 1-19 to 1-20, 3-28
    - handling, 5-16
    - LCW processor units, 1-9, 1-22 to 1-23, 3-28
    - maintenance procedures
      - checking air vents, 6-5
      - checking fans, 6-4
    - memory, 1-4
    - modules, 1-26
    - power codes, 3-22
  - PS power supplies, 3-20, 3-24
  - PS1 power supplies, 3-20, 3-24
- ## Q
- QIC tape drive maintenance, 6-8 to 6-11

## R

- rebooting a server, 6-16
- rebooting workstations
  - from a server hard disk, 6-16
  - general discussion, 6-15 to 6-17
  - LCW processor units, 6-15
  - preparation, 6-15 to 6-16
  - rebooting a server, 6-16
- regular maintenance procedures
  - checking fans, 6-4
  - cleaning workstations, 6-4
  - for modules, 6-3
  - for processor units, 6-3
  - for tape modules, 6-5 to 6-11
  - general discussion, 6-2 to 6-14
- related documentation, xviii to xxi
- repairing workstations (*See* troubleshooting)
- Reset switch, 6-17
- RS-422/485 cluster connection, 4-7 to 4-8

## S

- safety precautions, 5-15
- SCSI bus
  - expansion modules, 2-9 to 2-10
  - general discussion, 2-8
  - upgrade modules, 2-9 to 2-11
- SCSI modules
  - B28/B38 processor units
    - length of module string, 3-3 to 3-4
    - number of devices, 3-3 to 3-4
  - B39 processor units
    - length of module string, 3-6, 3-8
    - number of devices, 3-6, 3-8
  - EXP processor units
    - length of module string, 3-3 to 3-4
    - number of devices, 3-3 to 3-4
    - GXL processor units
      - length of module string, 3-3 to 3-4
    - number of devices, 3-3 to 3-4
- servers
  - rebooting, 6-16
  - turning off, 6-18
  - types of, 4-6
- SG-120-D monitors, 1-30, 2-4 to 2-5
- shipping environment, A-3
- SIMMs, 1-13, 1-24
- site preparation, 5-2
- special attachments
  - MCRs, 1-30
  - mice, 1-30
  - PIN keypads, 1-30
- special maintenance procedures
  - moving modules, 6-19
  - moving workstations, 6-19
  - power failures, 6-20
  - rebooting workstations, 6-15 to 6-16
  - turning off workstations, 6-18
- standard error codes, 7-7
- star topology, 4-14
- status codes
  - converting status codes, 7-11, 7-13
  - display methods
    - 7-segment display, 7-14
    - keyboard LEDs, 7-10
    - monitor screen, 7-10
    - speaker system, 7-14
  - general discussion, 7-2, 7-7 to 7-15
  - handling, 7-15
  - types of
    - standard error codes, 7-7
    - workstation startup status codes, 7-8
- surge protection, 3-27

### T

- tape cartridges, 6-11
- tape modules
  - cleaning tape heads, 6-5 to 6-10
  - cleaning modules, 6-4 to 6-5
  - general discussion, 1-26
  - power codes, 3-22
- TEL Voice Processor modules
  - cluster access, 4-4
  - general discussion, 1-26, 3-11, 3-13
- TeleCluster configurations
  - cluster connection, 4-7 to 4-8
  - troubleshooting, 7-6
- TEM teller extension modules, 2-4 to 2-5
- terminology, xvii to xviii
- token ring LANs
  - sending packages, 4-14
  - topology, 4-14
- TR2 LAN module, 3-11 to 3-12, 4-14
- topology
  - bus, 4-12
  - star, 4-14
- TR2 LAN modules
  - cluster access, 4-4
  - general discussion, 3-11, 3-13, 4-14
- troubleshooting
  - diagnostic tests, 7-18
  - general discussion, 7-2 to 7-18
  - installation problems, 7-4
  - LAN networks, 7-6
  - monitor problems, 7-5
  - mouse problems, 7-6

- no communications with server, 7-6
- no power to system, 7-4
- preliminary checks
  - checking cables, adapters, 7-4
  - checking LEDs, 7-4
  - power supply connectors, 7-4
- status codes, 7-2, 7-7 to 7-8
- TeleCluster configurations, 7-6
- workstation does not boot, 7-6
- TS tape modules, 3-11
- TS2 tape modules, 2-11 to 2-12

### U

- unpacking a workstation, 5-10

### V

- VDC monitors, 1-30, 2-4 to 2-5
- VDM monitors, 1-30, 2-4 to 2-5
- VG1 X-Bus cards, 2-2, 2-5
- VG2 graphics modules, 2-4, 2-17
- VG3 X-Bus cards, 2-5, 2-17
- VG4 graphics modules, 2-4, 2-17
- VGA monitors, 1-30, 2-4 to 2-5
- VGA-200-MON monitors, 1-30, 2-4 to 2-5
- VGA-931-VDM monitors, 1-30, 2-4 to 2-5
- VGM X-Bus cards, 2-5
- video cable
  - GXL processor unit, 2-19
  - VGA monitor, 2-19
  - video adapter, 2-19
  - VKA adapter, 2-19
- Visinostics, 7-18

---

## W

### WANs

- attached to DCX modules, 4-4
- attached to DN2 modules, 4-4
- attached to ID2 modules, 4-4
- attached to IDS modules, 4-4
- cluster access, 4-4
- general discussion, 1-3
- wide area networks (*See* WANs)
- workplace, 5-8 to 5-9
- workstation configurations
  - compact workstation, 3-28
  - general discussion, 3-27 to 3-29
  - graphics workstation, 3-28
  - high performance workstation, 3-28
- workstation startup status codes
  - bootstrap ROM status codes, 7-8
  - display methods
    - general discussion, 7-8, 7-10
    - keyboard LEDs, 7-10
    - monitor screen, 7-10
  - system initialization codes, 7-8
- workstations
  - design concepts, 1-2 to 1-3
  - handling, 5-15 to 5-16
  - hardware components
    - memory expansion, 1-4
    - modules, 1-4
    - peripherals, 1-6
    - power supplies, 1-6
    - processor units, 1-4
  - maintenance, 6-1 to 6-20
  - media defects, 5-13 to 5-14
  - moving, 6-19
  - power failures, 6-20
  - record keeping, 5-10

- safety, 5-15
- sorting, 5-10
- turning off, 6-18
- unpacking, 5-10
- workstation specifications
  - electrical, A-3
  - environmental
    - general discussion, A-1 to A-3
    - nonoperating, A-2
    - operating, A-2
    - shipping, A-3

## X

- X100-MAU, 4-12
- X-Bus, 2-9, 3-28
- X-Bus and SCSI module
  - combinations
    - B28/B38 processor units
      - length of module string, 3-4
      - number of devices, 3-4
    - B39 processor units
      - length of module string, 3-8
      - number of devices, 3-8
    - EXP processor units
      - length of module string, 3-4
      - number of devices, 3-4
    - GXL processor units
      - length of module string, 3-4
      - number of devices, 3-4
- X-Bus cards
  - B28/B38 processor units, 2-4
  - B39 processor units, 2-5
  - EXP processor units, 2-6
  - general discussion, 1-6, 1-25, 5-16
  - GXL processor units, 2-7 to 2-8
  - handling, 5-16
  - LCW processor units, 2-8

**X-Bus disk expansion modules,**  
    2-11 to 2-12

**X-Bus disk upgrade modules,** 2-11

**X-Bus modules**

**B28/B38 processor units**

        length of module string, 3-3

        number of devices, 3-3

**B39 processor units**

        length of module string, 3-6

        number of devices, 3-6

**EXP processor units**

        length of module string, 3-3

        number of devices, 3-3

**GXL processor units**

    length of module string, 3-3

    number of devices, 3-3

    tape modules, 3-11

**X-Bus tape modules,** 3-11

**X100-MAU,** 2-20, 4-12

**XS6 disk modules,** 2-11 to 2-12

**XS7 disk modules,** 2-11 to 2-12

**XS8 disk modules,** 2-11 to 2-12

**XSA disk modules,** 2-11 to 2-12

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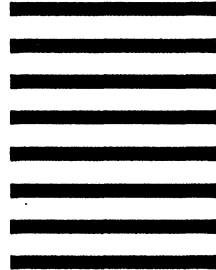
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